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THE CHADSEY-SKINNER ELEMENTARY ARITHMETIC

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ELEMENTARY ARITHMETIC

By

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ETC.

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THE
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PREFACE

Probably there is no branch of school study in which the work to-day is more unsatisfactory than in arithmetic; and yet accuracy in number work lies at the very base of efficiency in business affairs. Since much of the inefficiency of the time is clearly attributable to vagaries in educational methods, the exploitation of theories sometimes fantastic and demoralizing, there is a wide and growing desire for a return to the efficiency of an earlier period, when sane and conservative counsels were followed; when the drill was sufficient to insure a ready command of arithmetical processes by the pupil, and the learner was practically trained for the business of life.

Truly conservative as this new series is planned to be, in reviving those features of the work which made for efficiency in the past, it is thoroughly modern in its adaption to the conditions of to-day. The obsolete is eliminated. An application is made to the life of the present time in both thought and environment. So many are the distinctive features of this series, and so definite and positive are the principles upon which it has been constructed, that a brief statement of some of the more important of these features should be made in advance, to give a clear idea of the plan and purpose of the books.

Since the ear as well as the eye is a potent means of fixing in the mind that which is to be committed to memory, there is every reason for *oral drill work* in the mastery of tables, etc.*

Why should fifty per cent of the child's God-given equipment for storing the mind be discarded, and dependence be placed upon "visualization" alone?

---

*See explanatory note on page 28.

The very general slighting of systematic "table work" in the schools of this country has proved a sad mistake. The combinations of simple numbers in the elementary processes are presented here in tabular form, and without disguise; and they are to be learned in an orderly way. The elimination of the multiplication tables from some arithmetics, and the half-hearted and almost furtive use of them in others, are not easily explained.

Teachers complain that much that is called *addition* in school work is really only *counting;* that the pupil who is to add together two simple numbers will begin with one of these, and mentally count through the units of the other. This evil is almost universal. But who is to blame for it? The pupil? No. *He has been taught to do that very thing.* Either he has not been taught the difference between adding and counting in combining two or more numbers, or no substitute for counting has been given him. In this series, addition in arithmetic is defined to be *"adding without counting;"* and in all sincerity and good faith the pupil is told that he must learn some combinations before he can add in this way. He is not first taught to "add by counting" and then reproved for doing what he was taught to do.

A feature characteristic of this series throughout is its showing of the progressive development of the science of numbers. No pupil who studies these books will share the popular illusion that arithmetic as a finished product was in some mysterious way, at a very remote period, delivered to men. Contrariwise, he will learn how the use of numbers and of figures has been developed by entirely human, slow, and irregular advances from crude beginnings as the needs of the people urged them from step to step. The child accustomed to fairy tales should be led to make a clear distinction between the magical and the rational; and arithmetic will possess for him far more of human interest when it is presented to him without mystery as a science and art far from perfect, far from complete, and representing the results attained thus far by beings like himself.

Entirely consistent with the conservatism shown in the drill work in the mastery of combinations of simple numbers, etc., is the extended drill in abstract numbers, throughout the course. It is this practice that gives real efficiency, insuring readiness, accuracy, and speed. For the abundance of this work, which it is believed the pupil will enjoy if he be properly directed, no apology is offered. The need of the hour is for efficiency.

While the concrete problems are subordinated to the abstract as promoters of efficiency, they are yet of great importance. Care has been taken to render them interesting. Some characters of juvenile literature, historical or otherwise, and of folklore have been drawn upon. These are believed to be quite as admissible as the equally supposititious "Mary," "Clara," "John," "William," etc. of the conventional concrete problem. Further, the great mass of the concrete work deals with modern life and present environment; with the world's work; with the practical concerns of individuals and of peoples of this era. The concrete problems, therefore, possess an educative value apart from the number work involved in them. They have a cultural value and a vocational suggestiveness that should not be left out of account. They suggest, moreover, improvements, conveniences, and economic advances in home and neighborhood life.

In this first book of the series, fractions have not been presented in a technical way. Fractional parts of objects have been presented graphically to the eye, for comparison with each other and with the whole; and they are dealt with by an application of the fundamental processes learned in the use of whole numbers.

For expert advice in the proportioning of the work, and its adaptation to specific grades, and for sedulous care in the arrangement of its parts in supervising its make-up, acknowledgment is made to Mr. James C. Thomas, whose long and fruitful experience in schoolbook publishing qualifies him to be of the greatest service in all the innumerable details.

Credit is due to Mr. Charles L. Spain, Assistant Superintendent of the Detroit City Schools, for the valuable material supplied in the "Exercises for Practice" given on pages 221-236.

To educators who are seeking an arithmetic course prepared with a view to the practical efficiency of the pupil in all forms of number work, who desire that the pupil be interested in his work, and who have regard for the "by-products" of cultural development and for the training of the judgment in dealing with practical matters, this series is offered in a sincere and earnest effort to meet the needs of to-day.

CHARLES E. CHADSEY
HUBERT M. SKINNER

February, 1914

SUGGESTIONS TO TEACHERS

In entering upon the teaching of arithmetic, as in entering upon any other business, the first thing to be done is to *"take account of stock";* to ascertain what knowledge of the subject the pupil possesses, to start with. The first test of the pupil's knowledge should be the test of counting. In all probability he has learned to count before entering school; but in any event this should be taken up first, as a test, for the following reasons:

1. It will not do to assume that *all* first-year pupils can count.
2. Even if they all can do this in a way, there may be foreign pupils who are not sure of the English names of some of the simple numbers, and who will be at a disadvantage if they are not set right at once.
3. Many native American pupils do not pronounce correctly. They will say *"for"* for *four; "leb'm"* for *eleven; "twunty"* for *twenty*, etc.
4. Counting by odd and even numbers separately is useful in locating street numbers in cities, and in other matters, and should be taught at the outset. Counting by even numbers, only, saves a great deal of time when many things are to be counted. The pupil should learn to take advantage of it.

The first recording of numbers should be by the use of tally marks. This simple device of centuries past belongs to the folklore of our race, and is useful for many purposes to-day in city and country alike. It should not be left to chance for pupils to learn it. Every school should teach it.

The invention of our convenient and beautiful figures marked an era in human history. The child should see how the figures came naturally, by an arrangement of marks or of sticks. They will then have for him more of interest and more of meaning.

The decimal system in counting is based on the fingers of the human hand, and is best explained by the use of fingers as objects. "Once around" (10) explains tens' place of figures, and this explains all the others.

It is a mistake to teach the combinations of units and tens without first teaching both units and tens separately. Units are easily understood, and so are tens. The names of some of the tens, however, require some explanation; for they all have a *meaning.* *Eleven* and *twelve* and the *teens* are complex, and should be presented later. The meaning of *cleven* and *twelve,* and the construction of the *teens* should be made clear to the pupil.

The convenient modern plan of reading the tens first, and saying *twenty-five* instead of the old-fashioned *"five and twenty"* should be noted. In this economic age, even the little child should be taught economy of time and of effort by illustration.

The mastery of the *period of threc places* is the basis of all notation and numeration. The mastery of *one* period will answer for *all* periods—for periods differ from each other in *name,* not in form. The old, bewildering series of *"orders"*—units, tens, hundreds, thousands, tens of thousands, hundreds of thousands, millions, tens of millions, etc., is not to be treated as a merely curious palindrome (backward and forward alike), but must be *completely reversed* with *great speed* in reading figures. The true series of places—*units, tens, hundrds, in each period*—is simple and intelligible.

When the pupil comes to addition, *counting must stop.* It is a common complaint that in many schools there is *no true addition at all;* the pupil simply counts from one number through the units of another. Neither he nor his teacher knows why the work is so poor and inefficient. The textbook has taught the pupil to learn the sum of two numbers in this way. The teacher who finds what the trouble is, works hard to stop it, but it is now too late. *Prevention is better than cure.* From the first illustration of addition, counting should be wholly absent. The combinations of simple numbers must be *learned.* The ear aids the memory. Oral repetitions of combinations, sometimes in concert, will aid in their mastery. The combinations must be *memorized* if the pupil is ever to learn to add quickly. Abstract combinations must therefore precede concrete examples.

The combinations should be correlated in a simultaneous presentation, thus:

$$2 + 3 = 5 \qquad 3 + 2 = 5$$

U. S. money may be treated exactly like simple numbers if the child is taught that *the dollar is the unit,* and that dimes and cents are *not a part of the period,* but are cut off from it by the decimal point. A child naturally regards the dollar as a *hundred,* because it contains one hundred cents; and the dime as a *ten,* because it contains ten cents. Regarded as always a *unit,* the dollar may be treated like any other unit in *simple numbers.*

In subtraction, the difference between simple numbers should be committed to memory, as the sums of simple numbers should be in *addition.* They should likewise be correlated.

In some textbooks of arithmetic there is Babel indeed in multiplication.

The statement "$2 \times 4 = 8$" is variously read as follows:

Two times four *are* eight.
Two times four *is* eight.
Two multiplied by four *equal* eight.
Two multiplied by four *equals* eight.

In the first two readings, *two* is the multiplier.

In the last two readings, *four* is the multiplier. If there must always be a multiplier and a multiplicand, who is to tell, from the figures above, which is which? Some say that 2 is "taken" four times, or that 4 is "taken" twice.

Why all this psychological bewilderment as to singular and plural, and as to "taken" and "times"? As a matter of fact, we should say, simply and naturally:

Two 4's are 8. Four 2's are 8.

In multiplication, more than in anything else in arithmetic perhaps, the schools are apt to fail. It was long a scandal that pupils in the back part of an arithmetic would turn back to refer to the convenient tables of numbers near the beginning of the book. Instead of mastering these, they used them simply for reference. There is no good excuse for indulging or tolerating this abuse of the tables. The remedy for such an evil is to make sure that the tables are thoroughly mastered.

A strong protest against substituting "memory work" for reasoning in geometry and in history has led some teachers into a blind, unreasoning hatred for "memory work" of any kind; and they seem to be oblivious of the fact that arbitrary measures and fixed relations of numbers, if mastered, *must* be, in their very nature, matters for "memory work," pure and simple. This memory work should be well and thoroughly done, as a preparation for the business of a lifetime.

The amount of individual and concert recitations in the oral work presented in this book must depend in a measure upon circumstances. The oral work as suggested on page 28 offers an excellent opportunity to inculcate clear and pure expression; it is a valuable means of vocal training, as well as an aid to the mastery of the arithmetical work.

The theory that children amused by pedagogical devices will *incidentally* and almost unconsciously assimilate that which is *the direct end and purpose of the teaching*, or that the pupil should be led almost imperceptibly up an inclined plane, is a fallacious one in teaching. There is a moral stimulus in conscious and even taxing effort. There is a satisfaction in having mounted consciously a step—a clearly defined step—in an advance movement. Arithmetic study may be made interesting work, gratifying work, highly useful and commendable work—but still it is, in its nature, *real work* for the pupil; and it is better for him that this fact be recognized, and not disguised or ignored.

In this book are purposely included some words not usually found in the vocabulary of pupils of the fourth and fifth grades. By the acquisition of these words in this natural manner, the pupil will find his vocabulary enlarged as an incidental result of his study. No teacher should trust to a mere guess for the pronunciation or meaning of an unusual word. A dictionary should be consulted where there is any doubt as to such words as aviation, aeroplane, asphalt, sumac, etc.

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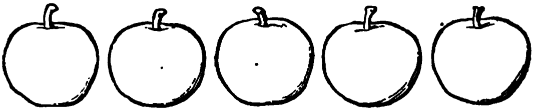
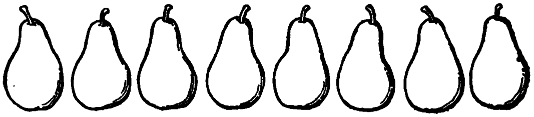
Elementary Arithmetic

PART I

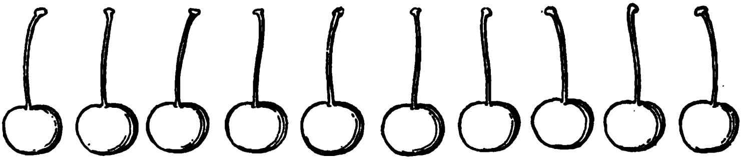
COUNTING



How many apples do you see in this row?



How many pears are there here?



How many cherries are there in this row?

Count from one to five.
Count from one to ten.
Count from two to eight.
Count from two to ten.
Count from five to ten.
Count from eight to twelve.

Count from one to twelve.
Count from five to fifteen.
Count from seven to thirteen.
Count from twelve to nineteen.
Count from ten to twenty.

All the numbers that have the syllable *teen* in their names are called *teens*.

What is the first of the teens? Count from one, and see.

What is the last of the teens? Count from thirteen, and see.

Count all the teens again, and see if you can tell how many there are.

When a person reaches the age of thirteen years, he is said to be in his teens.

How many years will you be in your teens?

One,..... three,..... five,..... seven,.....

What numbers are left out in this row?
Count from one to nine in this way.
Count from five to eleven in this way.
Count from nine to fifteen in this way.

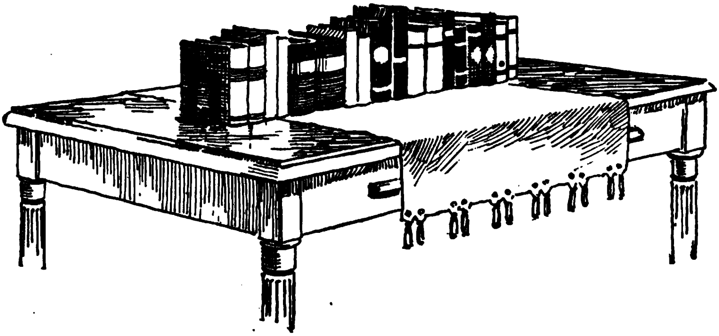
> *All the numbers counted from one in this way are called* **odd** *numbers.*

.....two,.....four,.....six,.........eight.

What numbers are left out in this row?
Count from six to twelve in this way.

Count from two to fourteen in this way.
Count from eight to sixteen in this way.
Count from four to twenty in this way.

> *All the numbers counted from two in this way are called* **even** *numbers.*



Count aloud each one of the tassels on the table scarf.

Now count the tassels in this way:

......**two,**......**four,**......**six,**....**etc.**

When you have many things to count in a row before you, can you save time by counting them in this way?

Are you sure of it?

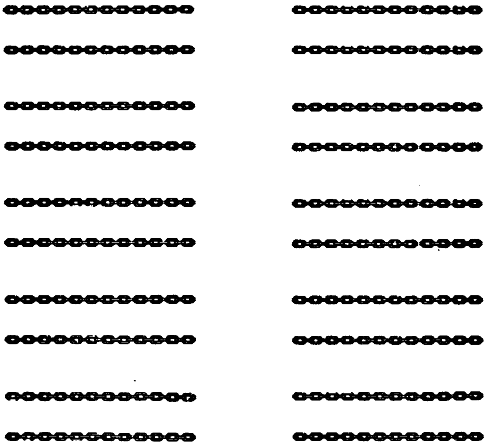
Count aloud each of the books on the table.

Now count the books in the other way.

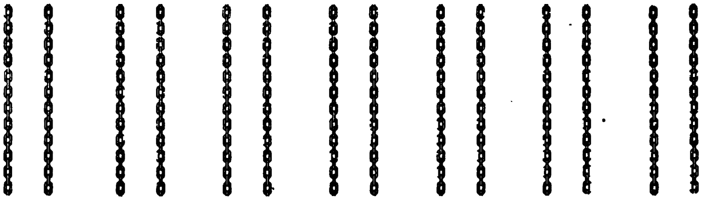
All the houses on one side of a street have odd numbers, generally, and all the houses on the other side of the street, have even numbers.

If your house is number eleven, how many numbers up the street will number nineteen be? If your house is number four, how many houses up the street will number ten be?

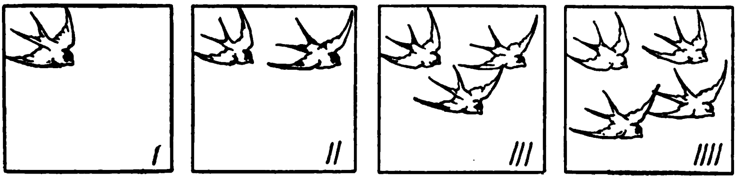
Count these one-inch chains by twos:



Count these one-inch chains by twos:



The teacher may place a small pile of shoe pegs on the desk of each pupil, to be separated (or picked up) and counted by twos. The pupils, in pairs, may exchange with each other the counted pegs, and these may then be re-counted, as a test of accuracy.



How many birds, and how many marks do you see in the first picture?

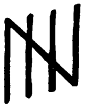
How many birds, and how many marks do you see in the second picture?

How many birds, and how many marks do you see in the third picture?

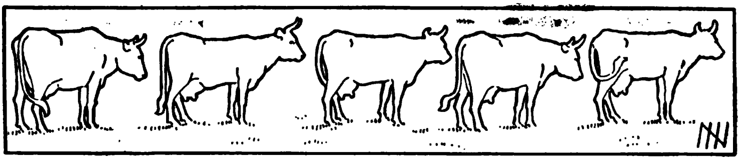
How many birds, and how many marks do you see in the fourth picture?

Marks like these, that are used in counting, are called *tally marks.*

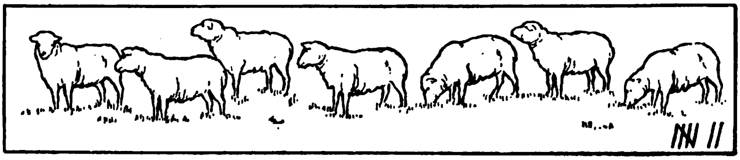
When four tally marks have been made, and one more is to be added, it must be marked across the others, in this way:



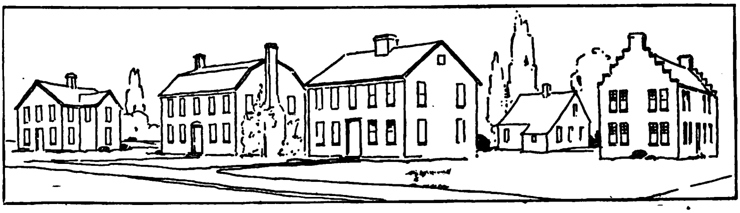
This cross mark is called the *tally.*



How many cows do you see in this picture? How many tally marks?



How many sheep are there?
How many tally marks?



How many houses do you see here? Mark the number in tally marks.

How many windows do you see? Mark the number of windows in each house separately.

How many doors do you see? Mark the number.

How many chimneys do you see? Mark the number.

Rise, and count the desks in your row, and keep count with tally marks. How many tally marks are there? How many tallies?

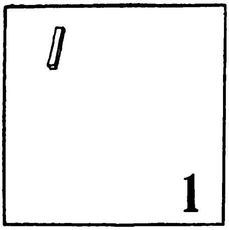
How many days are there in the week? Mark the number in tally marks. How many tallies are there?

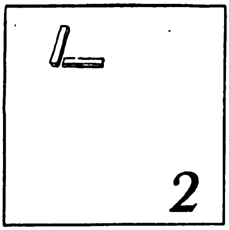
How many years old are you? Mark the number in tally marks.

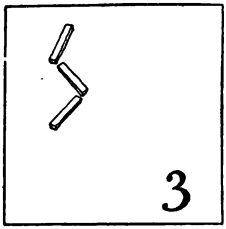
Tally marks are very helpful in counting things when there are many to be counted.

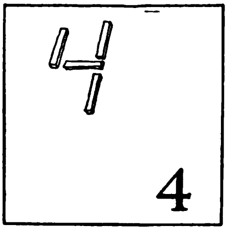
A single thing, or one, is called a *unit*.

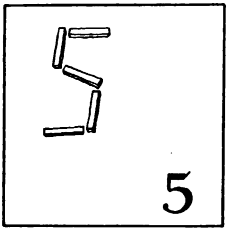
We may use sticks (or shoe pegs) for units. Count the sticks in each picture, and tell the figure that is in it.

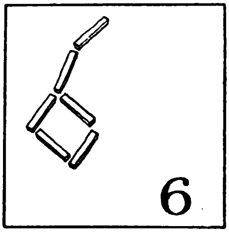


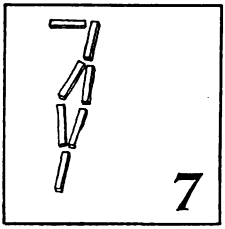


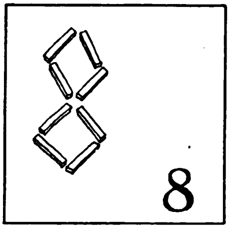


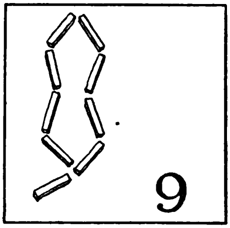








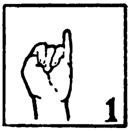


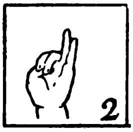


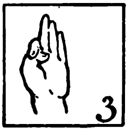
NOTE.—Teachers should explain to their pupils that this presentation illustrates the evolution of the digits that we use to-day, and carries us back to the earliest use of Arabic figures. The **5** probably was made originally in a slightly different form, like this . Ask the pupils to observe that *the number of straight lines in each figure corresponds to its number value*—one line for 1, two lines for 2, three lines for 3, four lines for 4, etc. Our present figures are simply the tally-mark principle differently applied.

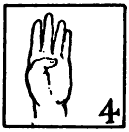
1. How many units are meant by the figure 5?
2. How many units are meant by the figure 3?
3. How many units are meant by the figure 9?
4. How many units are meant by the figure 7?
5. How many units are meant by the figure 6?
6. How many units are meant by the figure 2?
7. How many units are meant by the figure 4?
8. How many units are meant by the figure 8?
9. Arrange five shoe pegs to form in a crude way the figure 5.
10. Arrange eight shoe pegs to form in a crude way the figure 8.
11. Arrange shoe pegs to show the same number in tally marks.
12. Arrange seven shoe pegs to form in a crude way the figure 7.
13. Arrange six shoe pegs to form in a crude way the figure 6.
14. Arrange shoe pegs to show the same number in tally marks.
15. Arrange four shoe pegs to form in a crude way the figure 4.
16. Arrange nine shoe pegs to form in a crude way the figure 9.
17. Arrange three shoe pegs to form in a crude way the figure 3.
18. Arrange two shoe pegs to form in a crude way the figure 2.

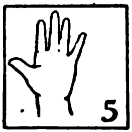
We may use our fingers for units.
What does *unit* mean?











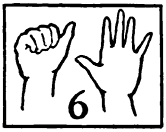
1. How many fingers do you see raised in the first picture, and what is the figure in it?

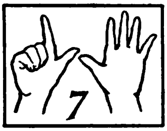
2. How many fingers do you see raised in the second picture, and what is the figure in it?

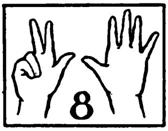
3. How many fingers are raised in the third picture, and what is the figure?

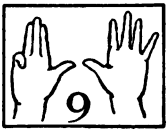
4. How many fingers are raised in the fourth picture, and what is the figure?

5. Counting the thumb as a finger, how many fingers are raised in the last picture?









6. How many fingers do you see raised in the first picture, and what is the figure?

7. How many fingers do you see raised in the second picture, and what is the figure?

8. How many fingers do you see raised in the next two pictures, and what are the figures?

1 2 3 4 5 6 7 8 9

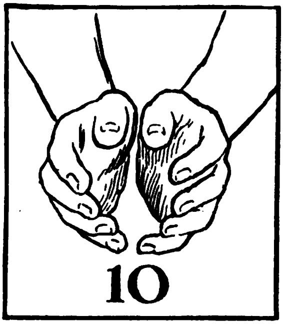
These nine figures are called *digits*. This is a very old word, and means *fingers.*

Men first learned to count with their fingers.

What do we call single things, or *ones?*

The nine digits may mean units of any kind.

There is no digit for the tenth finger, because when all the fingers are counted, we have gone all around both hands once, and we write the number in such a way as to mean *one time around.* One time around is *one ten.*



ONE TIME AROUND—ONE TEN

The round figure is called the cipher. It does not mean any number.

The digits are called *Arabic* figures, because the Arabs, who came to Spain from Asia, taught them to people of Europe. This was about a thousand years ago. Before that time our ancestors used letters for numbers, in a very inconvenient way. See page 121.

UNITS, TENS AND HUNDREDS

When different numbers of units are written, the figures should be in an up-and-down row. Such a row is called a *column.*

6
5
3
1

1. How many figures are there in this column?
2. How many units are meant by the first, or lowest figure?
3. How many by the second?
4. How many by the third?
5. How many by the fourth?
6. Read the column of figures.

2
9
4
7
3

7. How many figures are there in this column?
8. How many units are meant by the first figure?
9. How many by the second?
10. How many by the third?
11. How many by the fourth?
12. How many by the fifth?
13. Read the column of figures.

Read these columns:

(14)	(15)	(16)	(17)	(18)	(19)
6	8	9	2	4	7
9	7	6	8	3	5
3	5	4	6	9	4
4	6	7	4	6	3
2	3	3	7	1	2

Read these columns:

(20)	(21)	(22)	(23)	(24)	(25)
7	1	3	5	2	6
4	6	4	7	6	3
9	7	8	6	3	5
6	8	2	9	4	7

10

How many places of figures are there in this number?

The place at the right is called units' place, and the one at the left is called tens' place.

What is the figure in tens' place?

How many tens are there in this number?

What do we call the number?

The cipher in units' place shows that there are no units in units' place. Ten units make one ten, and there are no units left over.

The cipher does not mean any number, but is used to fill vacant places.

20

What figure is in tens' place in this number?

How many tens are there in the number?

Two tens are called *twenty*. What is the first syllable in the word *twen-ty?* Does it look like the old-fashioned word *twain,* which means *two?* How is that old word changed to make this syllable? The syllable *ty* means *tens.* What does *twen-ty* mean?

30

What figure is in tens' place in this number? How many tens are there in the number? Three tens are called *thirty.* What is the first syllable of the word *thir-ty?* How is the word *three* changed to make this syllable? In what other word have you found the same syllable? What does *thirty* mean?

40

What figure is in tens' place in this number? How many tens are there in the number? Four tens are called *forty.* What is the first syllable in the word *for-ty?* How is the word *four* changed to make this syllable? Is there any difference in sound between *four* and *for?* What is the sound of *o* in *four?* What is the sound of *o* in *forty?* What does *forty* mean?

50

What figure is in tens' place in this number? How many tens are there in the number? Five tens are called *fifty*. What is the first syllable in the word *fif-ty?* How is the word *five* changed to make this syllable? What does *fifty* mean?

60

What figure is in tens' place in this number? How many tens are there in the number? Six tens are called *sixty*. What is the first syllable in the word *six-ty?* What does *sixty* mean?

70

What figure is in tens' place in this number? How many tens are there in the number? Seven tens are called *seventy*. What are the first two syllables of the word *sev-en-ty?* What does *seventy* mean?

80

What figure is in tens' place in this number? How many tens are there in the number? Eight tens are called *eighty*. What is the first syllable of the word *eight-y?* How is the last syllable of the word shortened? Can you tell why? What does *eighty* mean?

90

What figure is in tens' place in this number? How many tens are there in the number? Nine tens are called *ninety*. What is the first syllable of the word *nine-ty?* What does *ninety* mean?

ONE LEFT

11

In this number, what figure is in units' place? How many units are there? What figure is in tens' place? How many tens are there? One unit and one ten are called *eleven*. This word is made from some very old words which meant *one left.* When you have eleven units and count out ten, you have one left. *Eleven* means *one and ten.*

12

In this number, what figure is in units' place? How many units are there? What figure is in tens' place? How many tens are there? Two units and one ten are called *twelve.* This word is made from some very old words which meant *two left.* When you have twelve units and count out ten, you have two left. *Twelve* means *two and ten.*

13

In this number, what figure is in units' place? How many units are there? What figure is in tens' place? How many tens are there? Three units and one ten are called *thir-teen.* What is the first syllable of this word? How is the word *three* changed to make this syllable? What is the last syllable of the word thir-teen? This syllable means *and ten.* What does thirteen mean?

14

How many units are there in this number? How many tens? What does *fourteen* mean?

15

How many units and how many tens are there in this number? What is the first syllable of the word fif-teen? How is the word *five* changed to make this syllable? What does *fifteen* mean?

16

How many units and how many tens are there in this number? What does *sixteen* mean?

17

How many units and how many tens are there in this number? What does *seventeen* mean?

18

How many units and how many tens are there in this number? How is the last syllable of the word eight-een shortened? Can you tell why? What does *eighteen* mean?

19

How many units and how many tens are there in this number? What does *nineteen* mean?

21

How many units and how many tens are there in this number? It would be very old-fashioned to call this number *"one and twenty."* What do we call it? Write the compound word *twenty-one.* What is a compound word? What is the use of the hyphen?

How many units and how many tens are there in each of these numbers?

22	28	23	24
29	25	27	26

In giving the names of all the teens, we name *the units first.* We say *fourteen, sixteen,* etc. In all the numbers above twenty, we name *the tens first.* We say twenty-one, twenty-five, etc., rather than *one and twenty, five and twenty,* etc., because it is more convenient to do so.

Have you ever seen these old fashioned lines?

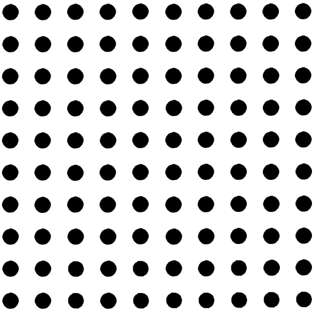
> "Four and twenty blackbirds baked in a pie."—MOTHER GOOSE.
> "Shepherd, hast thou not here thy ninety and nine?"—OLD HYMN.

Give the name of each of the numbers in the columns below, and tell how many units and how many tens there are in each.

1. 24
2. 46
3. 32
4. 17
5. 96
6. 83
7. 55
8. 74
9. 11
10. 43
11. 77
12. 39
13. 68
14. 12
15. 26
16. 81
17. 59
18. 37
19. 81
20. 22

Write:

21. Two tens and two units. What is the number?
22. Four tens.
23. Three units.
24. Seven tens and two units.
25. Eight tens and four units.
26. Six tens and two units.
27. Nine tens and six units.
28. Five tens and five units.
29. Seven tens.
30. Six tens and four units.
31. Three tens and seven units.
32. One ten and nine units.
33. Six tens and six units.
34. Eight tens and seven units.
35. Three tens and three units.



100

How many places of figures are there in this number? Beginning at the right, what is the first place of figures called?

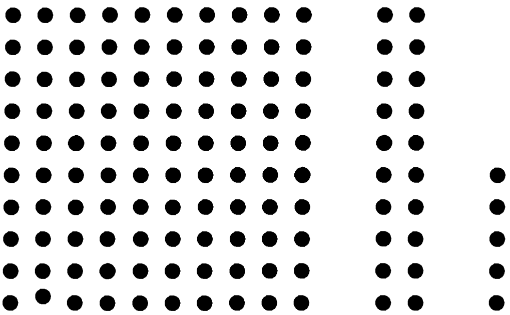
What is the second place called? The third place is called *hundreds' place.* One hundred is *ten tens.* We cannot write 10 in tens' place, because it takes two figures to write 10, and tens' place has room for only one figure; so instead of writing ten tens, we write one hundred, by writing 1 in hundreds' place, and placing the cipher in tens' place.

Give the name of each of the numbers below:

100
500
600
300
700
400
200
900
800

Write these numbers:

1. Two hundred
2. Five hundred
3. Nine hundred
4. Six hundred
5. Three hundred
6. Seven hundred
7. Eight hundred
8. Four hundred



125

How many units are there in this number? How many tens? How many hundreds? In reading the number, we must give the hundreds first. We call the number *one hundred twenty-five.*

103

How many units are there in this number? Are there any tens? What is in tens' place, and what does it mean? How many hundreds are there? We call the number *one hundred three.*

270

Are there any units in this number? How many tens are there? How many hundreds? What do we call the number?

Speaking the names of numbers is called *reading* numbers. Read the numbers in the four columns on the next page, and tell how many units, tens, and hundreds each number contains.

1. 111
2. 138
3. 246
4. 869
5. 427
6. 512
7. 752
8. 691
9. 444
10. 819
11. 319
12. 428
13. 773
14. 697
15. 582
16. 936
17. 471
18. 649
19. 753
20. 329
21. 221
22. 219
23. 352
24. 744
25. 631
26. 293
27. 428
28. 596
29. 855
30. 230
31. 197
32. 868
33. 179
34. 424
35. 668
36. 700
37. 910
38. 208
39. 399
40. 501

The act of reading numbers is sometimes called *numeration.*

Write in figures the numbers below:

1. One hundred twelve.
2. Six hundred thirty.
3. Two hundred fifty-four.
4. Nine hundred seventy-six.
5. Three hundred three.
6. Four hundred sixty.
7. Eight hundred fourteen.
8. Five hundred ten.
9. Seven hundred thirty-seven.
10. One hundred nine.
11. Three hundred thirty-three.
12. Two hundred one.
13. Nine hundred six.
14. Four hundred forty-four.
15. Seven hundred twenty.

16. Three hundred nine.
17. Nine hundred three.
18. Eight hundred sixty.
19. Seven hundred seventy-six.
20. Five hundred two.
21. Four hundred forty-nine.
22. Two hundred eleven.
23. Six hundred sixty-six.
24. One hundred eleven.
25. Three hundred thirty-three.
26. Five hundred fifty.
27. Nine hundred ninety-nine.
28. Eight hundred eighty.
29. Seven hundred seven.
30. Two hundred twenty.
31. One hundred nineteen.
32. Five hundred fifty-five.
33. Three hundred sixty.

All these are *abstract* numbers, because they are not applied to *things*. When we say "ten houses, "the word *ten* is not abstract, because it refers to things, it is a *concrete* number.

Concrete numbers are numbers applied to things. Abstract numbers are not so applied.

THE PERIOD

In Arithmetic, a number having three places of figures forms a *period.* The word *period* has also another meaning. What is it?

329

In this period, what figure is in the first place? What is in the second place? What is in the third place.

Name the places of figures.

It is easy to read large numbers, because they may all be divided into periods, and each period can be read separately. Large numbers are divided into periods by placing a comma for every three figures, counting from the right, to separate them. This is called *pointing off* the figures.

302,146

How many figures are there in this number? Where is the comma placed, to separate the periods?

How many periods are there? Beginning at the right, what number is in the first period?

What number is in the second?

Read each period as if it were alone, beginning with the second.

Note:—In this lesson no mention should be made of any number higher than hundreds. Each period should be read as if it were the only one.

To point off the figures of a large number, place a comma for every three figures, counting from the right, to separate the periods.

1,027

How many figures are there in this number? Do they make two *full* periods?

Which period has only one figure? Are there any hundreds in the first period? Are there any tens?

What does the cipher mean?

Read the first period. Read the second period.

How many places are vacant in the second period? We do not fill them with ciphers, because ciphers would not mean anything at the left of the number.

Now, read each period as if it were alone, beginning with the second.

29,631

In this number, how many figures are there in the second period? How many places are vacant in this period? Is there any cipher in the vacant place? Why not? Read each period as if it were alone, beginning with the second.

1,197,623

In this number, how many periods are there? Are they all full periods?

Read each period as if it were alone, beginning with the third.

The name of the second period is *thousands' period.*

The number in this period is the number of *thousands;* and every thousand is *ten hundreds.*

How many thousands are there in this number?

The name of the third period is *millions' period.* The number in this period is the number of millions; and a million is *one thousand thousands.*

How many millions are there in this number?

1,275,164

In this number, read the first period as if it were alone. What is the number in thousands' period? What is the number in millions' period?

Read each period as if it were alone, beginning with the third.

Now read the number in millions' period, and add the name of the period.

Now read the number in thousands' period, and add the name of the period. Now read the number of the first period.

Read all the periods in this way again.

In writing dates, we do not point off the number of the year in periods.

What year is this? Write the number of the year. If we should point off the number, how many periods would there be? Would the second period be a *full* period?

Instead of saying "one thousand, nine hundred," in giving the name of the year, what do we generally say?

218,270

Read each period of this number as if it were alone, beginning with the second. Now read each period, beginning with the second, and add the name of the second period to the number in that period.

1,001,001

In the first period, what number do we find? What places are filled with ciphers? What do the ciphers mean? How do we read this period?

In thousands' period, what number do we find? What places are filled with ciphers? How do we read the number in this period?

Read each period as if it were alone, beginning with millions' period. Now, read the number in each period, adding to each number the name of the period, excepting the first.

Read these numbers in the same way, first reading each period as if it were alone, and then reading the periods again and adding to each its name.

1. 206
2. 1,037
3. 2,549
4. 8,000
5. 1,000
6. 22,222
7. 31,010
8. 20,000
9. 100,000
10. 756,820
11. 275,001
12. 1,716,542
13. 2,000,000
14. 2,222,222
15. 3,003,003
16. 9,420,024
17. 1,010,101
18. 5,555,555
19. 2,002,002
20. 5,050,505
21. 9,999,999

A man who is worth a million dollars or more is often called a "seven figure man." Can you write a million in less than seven figures?

ADDITION

TWO AND THREE ARE FIVE

When two numbers are added together, to make a new number, they are called a *combination;* and the new number is called their *sum.*

What are the two numbers in this combination? What is their sum?

Mary had two cents, and her mother gave her three more. How many had she then?

If we have learned this combination, we do not have to start with two and count three more. We say at once, "She had five;" and we do not count at all.

Addition, *in arithmetic, is* **adding without counting.** *The Sign of Addition is* +.

In order to be able to add numbers in this way, we must learn the combinations.

This combination and sum may be written in this way:

$$\mathbf{2+3=5}$$

The sign between 2 and 3 is called *plus.* It shows that the two numbers are to be added. The sign between the combination and 5 is called *the sign of equality.* It means that the combination is *equal to* 5. We may read the line of figures in this way:

Two and three are five.

$$\mathbf{1+2=3}$$

What two numbers are here combined, and what is their sum?

$$\mathbf{2+1=3}$$

What two numbers are here combined, and what is their sum?

Are 2 and 1 the same as 1 and 2?

Write, and read in turn: *

1. $1+1=2$
2. $1+2=3$ $2+1=3$
3. $1+3=4$ $3+1=4$
4. $1+4=5$ $4+1=5$
5. $1+5=6$ $5+1=6$
6. $1+6=7$ $6+1=7$
7. $1+7=8$ $7+1=8$
8. $1+8=9$ $8+1=9$
9. $1+9=10$ $9+1=10$
10. $1+10=11$ $10+1=11$
11. $1+11=12$ $11+1=12$
12. $1+12=13$ $12+1=13$

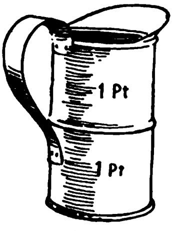
Read the combinations in concert.

Recite them from memory.

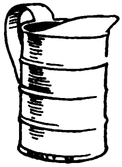
---

*Since the purpose of this tabular work is to secure a perfect mastery of the combinations, and since each statement relates to the uniting of two numbers only, the horizontal form of presentation is employed in preference to the vertical, as being better suited to oral work; just as the vertical arrangement, which follows this oral drill, is better suited to the written work.

†In reciting these combinations the individual and the concert recitation are both suggested. The concert recitation, it is believed, can be continued to advantage with the subsequent tables as indicated, though this is left optional with the teacher.



Quart



Pint

Gill

1. There are nine men in a baseball team. The team and the umpire are how many men?

2. A quart is two pints. A quart and one pint are how many pints?

3. There are four gills in a pint. How many gills are one pint and one gill more?

4. A caddie carrying golf clubs carried six in the bag and one in his hand. How many golf clubs were there in the set?

5. An Indian had eight arrows in his quiver and one in his bow. How many arrows had he?

6. A baseball team won five games during one month and one game the next month. What number of games did they win in the two months?

7. Lucile received seven bouquets when she was graduated and another came a day later. How many bouquets did she receive in all?

8. Harry rode nine miles in his uncle's automobile one day, and one mile the morning following. What number of miles did he travel in the two rides?

9. When Robinson Crusoe took Friday to his lonesome cave, how many men were there?

10. There are six teaspoons in a set. One set and one spoon are how many spoons?

Write, and read in turn:

1. $2+2=4$

2. $2+3=5$ $3+2=5$

3. $2+4=6$ $4+2=6$

4. $2+5=7$ $5+2=7$

5. $2+6=8$ $6+2=8$

Recite from memory.

6. How many are 2 and 3? 2 and 6? 2 and 2?

7. How many are 2 and 5? 2 and 1? 2 and 4?

8. How many are 3 and 2? 6 and 2? 1 and 2?

9. How many are 5 and 2? 7 and 2? 4 and 2?

10. If there are two flowers in one vase, and five in another, how many flowers are there in both?

11. John has two marbles, and Frank has six. How many marbles do the boys have in all?

12. If the mail-carrier delivers at a house two letters and three newspapers, how many pieces of mail does he deliver?

13. If George catches two fishes, and Frank catches five, how many fishes do they catch in all?

14. If Henry has four marbles, and Robert has two, how many do they have in all?

15. If one bush has six roses, and another has two, how many roses are there on the bushes?

16. If Edwin pays two cents for stamps, and five cents for picture cards, how much does he pay for them?

17. A yard is three feet. One yard and two feet are how many feet?

18. A gallon is four quarts. One gallon and two quarts are how many quarts?

19. A nickel is five cents. A nickel and two cents are how many cents?

20. If one suite* in a hotel has three rooms, and another has two, how many rooms do the suites have in all?

Write, and read in turn:

1. $2+7=9$ $7+2=9$
2. $2+8=10$ $8+2=10$
3. $2+9=11$ $9+2=11$
4. $2+10=12$ $10+2=12$
5. $2+11=13$ $11+2=13$
6. $2+12=14$ $12+2=14$

Recite from memory.

7. How many are 2 and 8? 7 and 2? 2 and 9?

8. How many are 2 and 10? 11 and 2? 2 and 12?

9. How many are 8 and 2? 2 and 7? 9 and 2?

10. How many are 2 and 11? 12 and 2? 10 and 2?

11. If the mercury in the thermometer rises two degrees, and then seven more, how many degrees does it rise?

12. If a clock is eight minutes too fast, and gains two minutes more, how much too fast is it?

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*Pronounced *sweet.*

13. If a garage* has two touring cars and seven runabouts, how many vehicles has it?

14. If one party line has two telephones, and another has five, how many telephones do the party lines have in all?

15. One terrace is two steps above the street. If another is seven steps higher, how many steps is it above the street?

16. If one city has two fire-engines, and another has nine, how many fire-engines do these cities have?

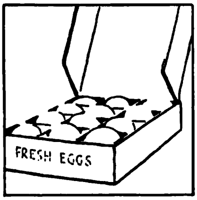
17. A dime is ten cents. A dime and two cents are how many cents?

18. A foot is twelve inches. A foot and two inches are how many inches?

19. Laura found four eggs in one nest and two in another. How many eggs did she find?

20. A quadruped has four feet. A true insect has two more. How many feet has a true insect?

21. One office building has three fire escapes, and another has two. How many fire escapes do the two buildings have?



22. An umbrella has seven ribs. Seven and two more are how many?

23. How many rows of grains are there on an ear of corn that you have examined? How many would two more rows make?

24. Twelve things are called a dozen. A dozen eggs and two eggs are how many eggs?

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*Pronounced *gȧ-räzh′*

Write, and read in turn:

1. $3+3=6$
2. $3+4=7$ $4+3=7$
3. $3+5=8$ $5+3=8$
4. $3+6=9$ $6+3=9$
5. $3+7=10$ $7+3=10$

Recite from memory.

6. How many are 3 and 7? 6 and 3? 3 and 5?

7. How many are 7 and 3? 3 and 5? 6 and 3?

8. How many are 3 and 3? 3 and 4? 7 and 3?

9. If there are three cows in one pasture, and seven cows in another, how many are there in both pastures?

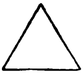
10. If there are three pictures on one page, and five on another, how many pictures are there on the two pages?

11. If there are seven bridges in one city, and three in another, how many are there in the two cities?

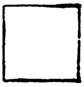
12. If there are three railways in one county, and four in another, how many are there in the two counties?

13. If one desk has two drawers, and another has nine, how many drawers do the desks have?

14. Seven days make one week. A week and three days are how many days?



15. A triangle has three sides, and a square has four sides. How many sides do they have in all?



Write, and read in turn:

1. $3+8=11$ $8+3=11$
2. $3+9=12$ $9+3=12$
3. $3+10=13$ $10+3=13$
4. $3+11=14$ $11+3=14$
5. $3+12=15$ $12+3=15$

Recite from memory.

6. How many are 3 and 8? 9 and 3?
7. How many are 12 and 3? 3 and 11?
8. How many are 3 and 9? 8 and 3?
9. How many are 3 and 12? 10 and 3?
10. How many are 3 and 10? 11 and 3?

11. If three parcels are sent by express, and eight by parcel post, how many are sent in all?

12. If in one city office there are three typewriters, and in another there are seven, how many typewriters are there in the offices?

13. If Arthur saves six dimes, and his brother saves three, how many dimes do they save?

14. If one nest has three eggs, and another has twelve, how many eggs do the nests have?

15. If eight boys form a club, and three more boys join it, how many members will the club have?

16. If there are three oak trees in one field, and ten in another, how many are there in these fields?

17. There are twelve inches in one foot. Three inches more will make how many inches?

18. A dime is ten cents. A dime and three cents are how many cents?

19. If the post office is eight blocks to the north, and the railway station is three blocks to the south, how far are these buildings apart?

20. A decade is ten years. How many years are a decade and three years?

21. An octave on the keyboard of a piano contains eight white keys. How many keys are an octave and three more keys?

22. In a certain art gallery one famous picture presents nine beautiful and happy persons and in another picture three others are shown. How many persons are there in the two pictures?

23. If you go seven miles one day, and three miles the next day, how many miles do you go in the two days?

Give the sums of these combinations:

2+9
3+7
8+3
9+2
12+3
9+3
2+6
2+4
2+2
2+9

6+ 3
5+ 2
3+ 2
3+ 8
2+ 8
8+ 2
3+11
3+ 9
3+ 3
3+10

2+ 7
6+ 2
2+ 5
10+ 3
11+ 2
4+ 3
12+ 2
4+ 2
2+12
5+ 3

10+ 2
3+ 6
7+ 3
2+11
3+12
2+ 5
7+ 2
3+ 4
2+ 3
11+ 2

Write, and read in turn:

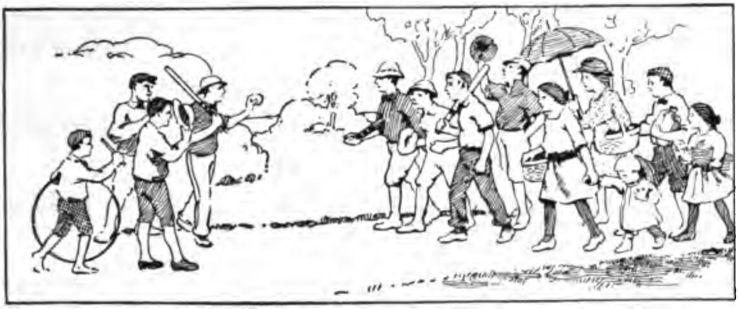
$$4+4=8$$

1. $4+5=\ 9$ $5+4=\ 9$
2. $4+6=10$ $6+4=10$
3. $4+7=11$ $7+4=11$
4. $4+8=12$ $8+4=12$

Recite from memory.

5. How many are 4 and 8? 6 and 4? 4 and 5?
6. How many are 4 and 7? 12 and 4? 2 and 4?
7. How many are 8 and 4? 4 and 4? 4 and 6?
8. How many are 5 and 4? 7 and 4? 9 and 4?
9. If Annie is four years old, and Jessie is eight, what is the sum of their ages?
10. If one lake contains five islands, and another contains four, how many islands are there in all?
11. If a trolley car goes north four blocks, and then east seven blocks, how many blocks does it go?

12. If one city flat contains eight rooms, and another contains four, how many rooms are there in the flats?
13. If one boat has four oars, and another six, how many oars have they in all?
14. If George catches six sunfishes and four bass, how many fishes does he catch?
15. Four boys and six boys are how many boys?



16. If four children in a park meet nine other children, how many children meet together?

17. If a lady has eight flowerpots and buys four more, how many has she in all?

Write, and read in turn:

1. 4 + 9 = 13   9 + 4 = 13
2. 4 + 10 = 14   10 + 4 = 14
3. 4 + 11 = 15   11 + 4 = 15
4. 4 + 12 = 16   12 + 4 = 16

Recite from memory.

5. How many are 4 and 11? 9 and 4?
6. How many are 4 and 9? 11 and 4?
7. How many are 10 and 4? 4 and 12?
8. How many are 4 and 10? 12 and 4?
9. One city has twelve wards, and another has four. How many wards are there in the cities?
10. One portico of a court-house has four columns, and another portico has eight. How many columns are there in the two porticos?

11. In one city block there are twelve stores and in another there are but four. How many stores are there in these blocks?

12. There are twelve men in a jury. The jury and four attorneys are how many men?

13. If you pay ten cents for peaches and four cents for apples, what do you pay for the fruits?

14. If one pasture contains nine acres, and another contains four, how many acres do they contain?

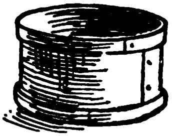
15. If you go away and visit for eleven days, and spend four more days going and returning, how many days will you be away from home?

16. If a certain railway station is four miles away, and a junction is nine miles further, how far away is the junction?

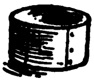
17. Twelve English pennies, or pence, make a shilling. One shilling and four pence are how many pence?

18. A bushel is four pecks. One bushel and three pecks are how many pecks?

Bushel Basket



Peck Measure



Quart

Pint

19. How many articles can you name that are usually measured in a bushel basket? In a peck measure? In a quart measure? In a pint measure?

Write, and read in turn:

1. 5+ 5=10
2. 5+ 6=11 6+5=11
3. 5+ 7=12 7+5=12
4. 5+ 8=13 8+5=13
5. 5+ 9=14 9+5=14
6. 5+10=15 10+5=15
7. 5+11=16 11+5=16
8. 5+12=17 12+5=17

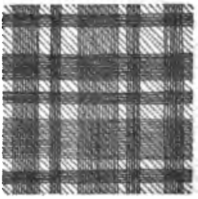
Recite from memory.

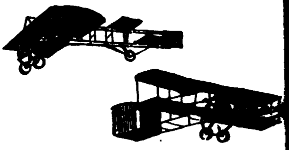
9. How many are 5 and 9? 7 and 5?
10. How many are 8 and 5? 5 and 6?
11. How many are 5 and 5? 10 and 5?
12. How many are 5 and 7? 5 and 10?
13. How many are 9 and 5? 12 and 5?
14. How many are 6 and 5? 5 and 12?
15. How many are 11 and 5? 5 and 8?

16. In a certain city there are five miles of asphalt streets, and nine miles of macadamized streets. How many miles are there of these, in all?

17. In one building, there are eight offices, and in another there are five. How many offices are there in all.

18. How many broad stripes are there in this tartan plaid, counted both ways? How many narrow stripes? How many stripes of both kinds?





20. At an aviation meeting there are five monoplanes and five biplanes. How many aeroplanes are there in all?

21. One nickel and four cents are how many cents?

22. In one county there are five telegraph stations, and in another there are twelve. How many telegraph stations are there in these counties?

23. In one restaurant there are eleven tables, and in another there are five. How many tables are there in these restaurants?

24. If you travel seven miles by land and five miles by water, how far do you go?

25. There are five volumes of one history, and six volumes of another history. How many volumes are there of the two histories?

26. Mary has five Plymouth Rock chickens, and eleven Black Minorcas. How many chickens has she?

27. The speedometers showed that one motorcyclist had traveled five miles, and another six, in the same time. How far had they traveled?

28. Frank has six Belgian hares, and his sister Minnie has five Maltese kittens, for pets. How many pets have they?

29. A foot and five inches are how many inches?

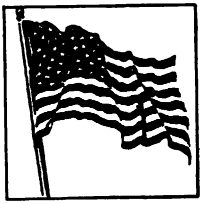
30. There are five trolley cars on one street car line and six on another. How many trolley cars are there on both of these lines?

Write, and read in turn:

1. $6+6=12$
2. $6+7=13$ $7+6=13$
3. $6+8=14$ $8+6=14$
4. $6+9=15$ $9+6=15$
5. $6+10=16$ $10+6=16$
6. $6+11=17$ $11+6=17$
7. $6+12=18$ $12+6=18$

Recite them from memory.

8. How many are 6 and 8? 9 and 6? 6 and 12?
9. How many are 11 and 6? 6 and 7? 8 and 6?
10. How many are 12 and 6? 6 and 9? 10 and 6?
11. How many are 6 and 10? 7 and 6? 6 and 11?
12. A livery man had eight horses, and bought six more. How many did he have then?
13. One hen has twelve chickens, and another has six. How many chickens do the hens have?
14. A hospital had six patients, and received nine more. How many patients did it have then?
15. At a hotel there are six arrivals from the east, and seven from the west. How many arrivals are there in all from these directions?



16. Our flag has seven red stripes and six white stripes. How many stripes has it?
17. Six flags and nine flags are how many flags?

18. If a boy enters school at the age of six and remains eight years in school, how old will he be then?

19. On a shelf there are six books. If I add twelve more, how many will there be?

20. If there are seven oak trees and six maples in a grove, how many trees are there?

21. One year a river rose eight feet above low water, and another year it rose six feet higher. How high did it rise the second year?

22. Romulus saw twelve vultures, and Remus saw six. How many vultures did they see?

23. A foot and six inches are how many inches in all?

24. In a certain field there are six stalks of the harmless sumach with red berries, and seven of the poisonous sumach with greenish white berries. How many sumach stalks are there in all?

25. A true insect has six legs. A spider has eight. How many legs in all have an insect and a spider?

26. If a statesman serves in Congress as a Representative for eight years and as a Senator for six years, how many years does he serve in Congress?

27. If a boy spends six hours of the day in school and six more in an office, how many hours does he spend away from home?

28. In a pasture are six cows standing, and six more lying down. How many cows are there in all?

29. Six school library books and nine school library books are how many books?

Write, and read in turn:

1. 7+7=14

2. 7+ 8=15 8+7=15

3. 7+ 9=16 9+7=16

4. 7+10=17 10+7=17

5. 7+11=18 11+7=18

6. 7+12=19 12+7=19

Recite from memory.

7. How many are 12 and 7? 7 and 9? 8 and 7?

8. How many are 7 and 7? 10 and 7? 7 and 11?

9. How many are 7 and 8? 12 and 7? 7 and 10?

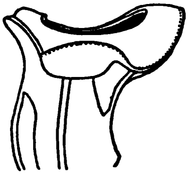
10. There were seven wise men of Greece, and seven kings of Rome. How many of these wise men and kings were there in all?

11. A certain factory uses 7 circular saws and eight band saws. How many saws does it use?

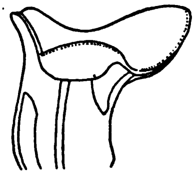
12. Samuel has nine Merino lambs, and seven Cotswolds. How many lambs has he?

13. A plantation has twelve draft horses, and seven saddle horses. How many horses are there?

14. In a hunting party, seven of the men used the humane McClellan saddles, and the other eight men used common saddles. How many saddles were there in the party?

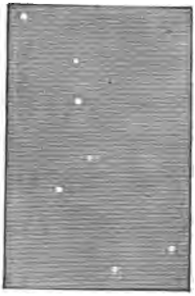


McClellan saddle



Common saddle

15. Julia painted ten Easter cards, and Helen painted seven. How many did they paint?



16. There are seven bright stars in Orion, the most splendid group of stars in the heavens; and seven bright stars in the Great Dipper, which points to the North Star. How many bright stars are there in all, in these two groups?

17. A party of seven Boy Scouts signaled to another party of eleven. How many Boy Scouts were there in all?

18. In a new suburb there are twelve houses of artificial stone, and seven of brick. How many houses are there in all?

19. In a railway coach seven passengers are supplied with sanitary cups for drinking, and nine others are not supplied. How many passengers are there in the coach?

20. In a rural district one drain serves for seven farm houses, and another drain serves for seven more. For how many farm houses do the drains serve?

21. A peck is eight quarts. A peck and seven quarts are how many quarts?

22. A dairy man owns nine Holstein cows and seven Jersey cows. How many cows has he in all?

Write, and read in turn:

1. $8+8=16$
2. $8+9=17$ $9+8=17$
3. $8+10=18$ $10+8=18$
4. $8+11=19$ $11+8=19$
5. $8+12=20$ $12+8=20$
6. $9+9=18$
7. $9+10=19$ $10+9=19$
8. $9+11=20$ $11+9=20$
9. $9+12=21$ $12+9=21$

Recite from memory.

10. How many are 8 and 11? 10 and 8? 8 and 9?
11. How many are 11 and 8? 8 and 9? 12 and 8?
12. How many are 8 and 8? 9 and 8? 8 and 10?
13. How many are 9 and 11? 12 and 9? 9 and 9?
14. How many are 9 and 12? 11 and 9? 9 and 10?
15. In a chorus there are eight men and twelve women. How many are there in all?
16. In a park a gentleman counted twelve teams with check reins, and nine without. How many teams did he count?
17. One foot and nine inches are how many inches?
18. Eleven clothespins and eight clothespins are how many clothespins?
19. A dredging company loads with sand eight scows in one day, and nine in another. How many scows does it load in two days?

21. Harold has eleven Pekin ducks and eight Rouen ducks. How many ducks has he?

22. One dynamo supplies eight farm houses with electric light, and is going to supply ten more. How many will it then supply?

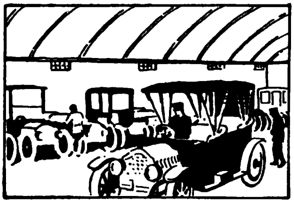
23. In a high school graduating class there are twelve girls and nine boys. How many are there in all?

24. The clerks of a department store include twelve women and eight men. How many clerks are there?

25. On a plantation there are eight horses and as many mules, for team work. How many of these animals are there in all?

26. At the age of twelve, Royall went to live with his uncle, with whom he remained for nine years. How old was Royall at the end of that time?

27. If Frank pays twelve dollars for clothing and eight for railway fare, how much does he pay in all?



28. One garage employs ten chauffeurs, and another employs eight. How many do the garages employ?

28. Josephine picked ten bowlfuls of currants, and nine bowlfuls of gooseberries. How many bowlfuls of berries did she pick in all?

29. Victor caught eight crayfishes in a stream, and twelve in a pond. How many did he catch in all?

Write, and read in turn:

1. $10+10=20$
2. $10+11=21$ $11+10=21$
3. $10+12=22$ $12+10=22$
4. $11+11=22$
5. $11+12=23$ $12+11=23$
6. $12+12=24$

Recite from memory.

7. How many are 10 and 11? 12 and 10? 11 and 11?

8. How many are 11 and 12? 11 and 10? 12 and 12?

9. Milton has twelve books of travel on his bookshelf and Edna has twelve story books on her bookshelf. How many of these books are there in all?

10. One fort contains eleven companies of soldiers, and another ten. How many companies do the forts contain?

11. In a clearing, twelve stumps were removed from one field, and eleven from another. How many stumps were removed from the fields?

12. In a restaurant, twelve patrons called for regular dinners, and ten ordered dinners selected from dishes of various prices named on the card. How many dinners were ordered?

13. A dozen buttons and eleven more are how many buttons?

Give the sums of these combinations:

4+9
8+8
11+4
4+12
4+5
10+5
7+7
11+10
12+2

6+8
6+4
9+7
8+7
5+7
11+5
11+12
8+6
11+6

3+12
7+8
5+4
9+10
6+9
12+9
4+8
12+6
4+11

11+7
9+5
7+11
5+6
10+12
9+6
10+10
4+10
7+2

9+8
2+9
3+6
5+8
7+5
9+4
8+2
6+2
4+3

4+6
9+9
2+8
3+3
11+11
2+12
6+10
3+7
11+2

8+9
6+5
4+2
5+11
8+3
9+7
11+3
8+5
7+4

8+11
3+5
6+7
12+4
3+11
10+3
10+8
4+7
2+11

2+7
3+4
5+9
7+6
9+2
8+4
6+3
4+4
7+3

12+7
6+12
6+6
12+10
10+4
12+5
7+10
11+8
12+8

5+10
10+6
12+6
9+11
7+9
11+9
5+12
9+3
10+7

5+5
10+9
8+12
3+9
12+11
8+3
7+12
9+12
12+12

TWO AND TWO AND THREE ARE SEVEN

Here are two combinations. The first combination is *two and two*, and their sum is *four*. This *four* and the *three* are the second combination. What is their sum?

1. How many are two and one and three?
2. How many are three and one and four?
3. How many are two and two and two?
4. How many are three and one and seven?
5. How many are two and two and ten?
6. How many are two and one and eleven?
7. How many are two and two and nine?
8. How many are one and three and six?
9. A base-ball club won three games, and then two more, and then three more. How many games did it win in all?
10. A traveling salesman had three sample trunks, a suitcase, and a valise. How many pieces of baggage did he have?
11. A lady buys two tables, two book-cases, and six chairs. How many pieces of furniture does she buy?
12. A steamboat company owns four screw propellers, two old side-wheel steamers, and four steam launches. How many vessels does it own?
13. A country club has three limousines, (*lē-mōō-zēnź*) four other automobiles, two surreys, and two sulkies. How many vehicles has it?

2	9	4
7	5	3
6	1	8

The Magic Square

14. Prove that in the magic square the figures in every row, if added, will equal fifteen. The rows may be added up and down, or right and left, or cornerwise.

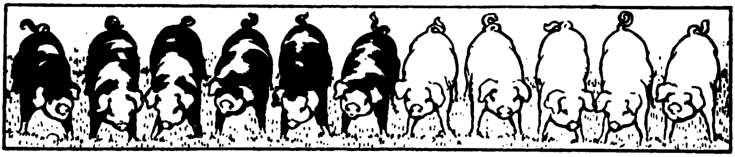
15. A violin has four strings, and a guitar has six. How many strings do they have in all? If I have a guitar, a violin, and a mandolin of eight strings, how many strings have I?

16. In Norse fable, Odin had for companions two wolves and a raven. How many companions had he? With six more, how many would there have been?

17. Mrs. Madison presided over the White House eight years while Thomas Jefferson was President, and eight years more while her husband, James Madison, was President. For how many years was she mistress of the White House?

18. In a certain city a bank has four columns; the court house, two rows of columns, five in each row; and a seminary, two rows of columns, four in each row. How many columns do these buildings have?

19. Here are six Berkshire pigs, and five Chester Whites. How many pigs are there in all?



WRITTEN ADDITION

$$\begin{array}{r} 2 \\ 4 \\ \underline{3} \end{array}$$

The line is drawn below this column of figures to show that the numbers are to be added. Their sum is to be written below the line.

Read the figures of the column, beginning at the bottom, and tell their sum.

Copy these columns, and write the sums below the lines:

1.	2.	3.	4.	5.	6.	7.	8.
		5	3	6	4	3	7
7	6	1	3	1	2	2	1
2	3	2	3	2	3	2	1

Read the figures in each column, and tell their sum.

$$\begin{array}{r} 14 \\ 21 \\ \underline{62} \end{array}$$

How many places of figures are there in each of these numbers?

Read the column of figures in units' place. Read the column of figures in tens' place.

What is the sum of the units? Where is it to be written?

What is the sum of the tens? Where is it to be written?

Copy the columns below; add the numbers in each column, and write their sum.

9.	**10.**	**11.**	**12.**	**13.**	**14.**	**15.**	**16.**
21	13	26	47	14	65	51	11
62	24	32	21	12	23	34	66

Read the numbers, beginning with the lower number, and tell their sums.

$$\begin{array}{r}\mathbf{36}\\ \underline{\mathbf{44}}\\ \mathbf{80}\end{array}$$

What is the sum of the numbers in units' column? We must not write a ten in units' place. We write a cipher in the vacant place.

Where does the ten belong? If it belongs in tens' place, it must be added to the other numbers in tens' place. This is called "carrying the ten."

What are the other numbers in tens' place?

What is the whole sum?

One and four and three are how many?

Copy the numbers below, and tell their sums.

17.	**18.**	**19.**	**20.**	**21.**	**22.**	**23.**	**24.**
18	21	25	34	27	72	36	23
12	19	25	56	13	18	24	37

$$\begin{array}{r} \mathbf{48} \\ \underline{\mathbf{61}} \\ \mathbf{109} \end{array}$$

What is the sum of the numbers in units' column? What is the sum of the numbers in tens' column?

Ten tens make one hundred. In what column does the hundred belong? If it belongs in hundreds' column, it must be written there. This is called "carrying the hundred."

Read the whole sum.

$$\begin{array}{r} \mathbf{175} \\ \underline{\mathbf{234}} \\ \mathbf{409} \end{array}$$

What is the sum of the numbers in units' column?

What is the sum of the numbers in tens' column? What do ten tens make? Can we write one hundred in tens' place?

Where does it belong? If it belongs in hundreds' column, it must be added to the other numbers in hundred's column. What are they?

What is the sum in hundreds' column? What is the whole sum?

$$\begin{array}{r} \mathbf{326} \\ \underline{\mathbf{731}} \\ \mathbf{1057} \end{array}$$

What is the sum of the numbers in tens' column?

What is the sum of the numbers in hundreds' column?

Ten hundreds make *one thousand.* We must not write the thousand in hundreds' column, because it belongs to thousands' period. We place a cipher in the vacant place, and write a comma to begin a new period. When we write the *one* in thousands' period, this is called "carrying the thousand."

> *Remember that ten units make one ten, ten tens make one hundred, ten hundreds make one thousand, ten thousands make one ten-thousand, etc.*

Add these numbers:

1.	**2.**	**3.**	**4.**	**5.**	**6.**
521	745	999	189	878	1,000
637	326	1	11	132	10

7.	**8.**	**9.**	**10.**
30,000	99,999	12,345	22,222
70,000	1	54,321	88,888

Add these columns without counting:

11.	**12.**	**13.**	**14.**	**15.**	**16.**
36	10	17	101	20	20
42	24	94	39	97	104
25	36	3	5	30	3
10	97	5	7	40	89

Test the pupils' progress by encouraging mental solutions of such of the following problems as can be solved easily in that way.

1. A blacksmith has three dozen horseshoes made for seven nails each, two dozen made for six nails each, and two dozen made for eight nails each. How many horseshoes has he in all?

2. In a certain period, nine hundred forty-six letters intended to go to California (Cal.) were sent to Colorado (Colo.), and six hundred twenty-nine intended to go to Colorado were sent to California (because the *Cal.* and the *Colo.* were not clearly written). How many were missent as a result of such carelessness?

3. The rainbow contains seven colors in regular lines. Where there is a double rainbow, how many lines of color are there?

4. A city real estate dealer had on his books "For Sale" and "To Rent" in the suburbs, eight frame houses with slanting roofs, three with gambrel* roofs, and two brick houses with Dutch* gables; and in the city, fourteen stone-front houses in blocks, with flat roofs. How many houses were there altogether?

5. There are 48 states in the Union, and nine Provinces in the Dominion of Canada. How many States and Provinces are there in all?

6. The population of Mexico in 1910 was 15,063,000. That of the Dominion of Canada was 7,205,000. What was the combined population?

*See illustration on page 6.

7. If a meeting that was appointed to be held on the 1st of the month be postponed for 2 weeks and then for 1 week longer, on what day of the month will it be held?

8. If a person has 2 living parents, 4 living grandparents, and 3 living great-grandparents, how many living ancestors has he?

9. If a person has 7 children, 6 grandchildren, and 4 great-grandchildren, all living, how many living descendants has he?

10. In 1913 the 4th of July fell on Thursday. It will fall on the same day 28 years later. In what year will that be?

11. Lord Dufferin became Governor-General of the Dominion of Canada in 1872, and served for eight years. In what year did he retire from the office?

12. There are eight States bordering on the Great Lakes, and five bordering on the Gulf of Mexico. How many Lake States and Gulf States are there together?

13. A farmer bought five hundred drainage tiles of a manufacturing company, and then made six hundred fifty for himself. How many did he have then?

NOTE: Pupils should have a thorough knowledge of the *Combinations in Addition* before advancing to the next subject. To insure this, frequent reviews and repeated drills on the *Combinations* are essential. No adequate progress is possible without a clear understanding of the fundamentals.

UNITED STATES MONEY

125 cents

How many cents are there here?

Ten cents make one dime, and ten dimes make one dollar.

125 cents equal 1 dollar, 2 dimes, and 5 cents. This amount of money is written in this way:

$1.25

How many places are there in a full period?

If we should count the cents as units, and the dimes as tens, and the dollar as hundreds, we should have a full period. But amounts of money are not written that way.

> *In United States money, the dollar is the unit. We must put a mark called a decimal point after the dollars, because the dimes and cents are not a part of the period of figures.*

Before the dollars we must make the sign $. It is called the dollar mark.

It is not a part of the period.

The decimal point is made like the period point.

$1.25

This means one dollar and twenty-five cents.

What figures are outside of the period?

What is the number in units' place?

How many dollars are there?
How many dimes are there?
How many cents are there?

$124.05

What is the number in units' place? In tens' place? In hundreds' place?

Is this a full period?
Read the number of dollars.
What two figures are outside of the period?
Which figure tells the number of cents?
Are there any dimes?
Read the whole number.

Read these amounts of money:

$1.75
3.60
5.02
6.10
4.18

$ 20.10
100.10
101.20
202.02
970.13

$119.07
728.00
630.02
100.01
365.50

$125.15
9.68
7.14
9.99
2.58

$ 680.00
347.60
770.07
100.01
1,805.15

$ 4,001.00
6,700.00
85,800.00
660,000.00
222,222.22

$600.00+$205.15

What is the first amount of money?
What amount is to be added to it?
What is the sum of the two amounts of money?

It is not necessary to repeat the dollar mark with each successive amount when the amounts are written in columns.

Write the following amounts of money, placing cents under cents, dimes under dimes, dollars under dollars, etc.:

1. One dollar and fifty cents.
2. Fifteen dollars and ten cents.
3. Sixty dollars.

Add these three amounts.

4. One hundred dollars.
5. Fifty dollars and five cents.
6. One dollar.

Add these three amounts.

7. One dollar and one cent.
8. One hundred one dollars.
9. One hundred dollars and one cent.

Add these three amounts.

10. Twenty-five dollars.
11. Twenty-five cents.
12. One dollar and one cent.

Add these three amounts.

13. Seventy-five dollars.
14. Two dollars and fourteen cents.
15. Six dollars and two cents.

Add these three amounts.

1. Our
2. United
3. States
4. Money
5. includes
6. cents,
7. nickels,
8. dimes,
9. quarters,
10. halves,
11. dollars,
12. ones,
13. twos,
14. fives,
15. tens,
16. twenties,
17. fifties,
18. hundreds,
19. gold,
20. silver,
21. paper,
22. alloy.

A	$126.75
C	43.91
D	2.80
E	65.32
F	49.25
G	861.14
H	231.19
I	320.19
K	48.37
L	621.20
M	115.87
N	35.73
O	630.24
P	28.10
Q	263.15
R	530.12
S	91.14
T	440.16
U	72.19
V	82.11
W	27.36
Y	946.28

Beginning with the letters forming the first word, write successively the amount opposite the index letter and find the sum as illustrated below. Follow with the other words in like manner.

(O) 630.24
(U) 72.19
(R) 530.12
?

SUBTRACTION

FIVE LESS TWO EQUALS THREE

Here we have found the difference between two and five.

The difference between the two numbers is found by taking one from the other.

What is the larger number? What is the smaller? What is their difference?

Finding the difference between numbers is called subtraction. The sign of Subtraction is —.

A short horizontal line between two numbers shows that the second is to be taken from the first. It is called *minus*. In reading numbers, it may be called *"less."*

The larger number is called the *minuend*, and the smaller number is called the *subtrahend*. *Minuend* means something to be di-*min*-ished, or made less. *Sub-tra-hend* means something to be sub-trac-ted, or taken away. When the cipher is read, it may be called "nothing," or "nought."

$$3-3=0$$

This may be read—

"Three less three equals nought."

5 − 2 = 3 **5 − 3 = 2**

What is the minuend in each case?

What is the subtrahend in each case?
What is the difference in each case?

If the difference be added to the subtrahend, their sum will always equal the minuend.

Try this with the numbers given. What is their sum in the first example? —in the second example?

Write, and recite from memory:

1. $2-2=0$
2. $3-2=1$ $3-1=2$
3. $4-2=2$
4. $5-2=3$ $5-3=2$
5. $6-2=4$ $6-4=2$
6. $7-2=5$ $7-5=2$
7. $8-2=6$ $8-6=2$
8. $9-2=7$ $9-7=2$
9. $10-2=8$ $10-8=2$
10. $11-2=9$ $11-9=2$
11. $12-2=10$ $12-10=2$
12. $13-2=11$ $13-11=2$
13. $14-2=12$ $14-12=2$
14. $15-2=13$ $15-13=2$

15. If you have a nickel and four cents, and lose two cents, how much money have you left?

16. If you buy eight cents worth of postage stamps, and pay for them with a dime, what change do you receive?

17. There are five senses—seeing, hearing, feeling, tasting, and smelling. Helen Keller can not see or hear or smell. How many senses has she?

18. If a man had eight apple trees and four pear trees, and two of his trees were killed by frost, how many has he left?

19. Two inches from one foot leaves how many inches?

20. How old were you two years ago?

21. There are nine members of a picnic committee in a certain school. If two members of the committee should be absent how many would be left?

22. Of 9 cents that Bennie lost on his way home from the Post Office 7 were found again. How many were not found?

23. In old times, thirteen cookies were called a "baker's dozen." What was the difference between that and a real dozen, or twelve?

24. A nickel and a dime, less two cents, are how many cents?

25. A half-dollar equals ten nickels, and a quarter equals five nickels. If you have a half-dollar and a quarter, and buy a dime's worth of candy, how many nickels will you have left?

Write, and recite from memory:

1. $4-3=1$ $4-1=3$
2. $5-3=2$ $5-2=3$
3. $6-3=3$
4. $7-3=4$ $7-4=3$

5. $8-3=5$ $8-5=3$
6. $9-3=6$ $9-6=3$
7. $10-3=7$ $10-7=3$
8. $11-3=8$ $11-8=3$
9. $12-3=9$ $12-9=3$
10. $13-3=10$ $13-10=3$
11. $14-3=11$ $14-11=3$
12. $15-3=12$ $15-12=3$

13. If a pair of shoes costs $3.00, and you pay for them with a ten-dollar bill, how much money will you receive in change?

14. If a merchant sells $6.00 worth of goods, and receives in payment a five-dollar bill and a two-dollar bill, how much must he give back in change?

15. There are eight quarts in a peck. If a man lacks three quarts of having a peck of beans, how many quarts has he?

16. If the train leaves at noon, and a traveler is ready to leave at nine o'clock in the morning, how long will he have to wait?

17. If you have eight nickels, and buy a quarter's worth of stationery, how many nickels have you left?

18. If a jury of twelve men disagree, and three men believe the prisoner to be guilty, how many believe him to be not guilty?

19. In one year there are twelve months. If a student is absent from home nine months in the year, how long is he at home?

20. If a man buys a necktie for a half-dollar, and a collar button for a dime, and pays with a half-dollar and a quarter, his change will equal how many nickels?

21. Three months ago a note was given for a year and two months. In how many months will it become due?

22. If you have seven cents, and find a nickel, and then lose three cents, how much money will you have?

Write, and recite from memory:

1. 6 − 4 = 2   6 − 2 = 4
2. 7 − 4 = 3   7 − 3 = 4
3. 8 − 4 = 4
4. 9 − 4 = 5   9 − 5 = 4
5. 10 − 4 = 6   10 − 6 = 4
6. 11 − 4 = 7   11 − 7 = 4
7. 12 − 4 = 8   12 − 8 = 4
8. 13 − 4 = 9   13 − 9 = 4
9. 14 − 4 = 10   14 − 10 = 4
10. 15 − 4 = 11   15 − 11 = 4

11. Of six men and five women in an office, only seven persons are vaccinated. How many are not vaccinated?

12. If you change a half-dollar and two dimes into nickels, and spend two nickels, how many nickels will you have left?

13. A quarter and three nickels less four nickels equal how many nickels?

14. Of nine men in an office, four have their life insured. How many of them are without life insurance?

15. Five cents and four cents and six cents less four cents leaves how many cents?

16. Five men and two men less three men are how many men?

17. If you give a half-dollar to pay for things that cost three dimes, how many nickles can you receive in change? How many dimes?

18. A man bought twelve tons of coal, and then three more, and used eleven tons. How many tons has he left?

19. A newsboy had twelve papers, and got twelve more, and sold twenty-one. How many had he left?

20. A dime and two nickels and four cents, less three cents, is how much money?

Write, and recite from memory:

1. $7-5=2$ $\qquad$ $7-2=5$
2. $8-5=3$ $\qquad$ $8-3=5$
3. $9-5=4$ $\qquad$ $9-4=5$
4. $10-5=5$
5. $11-5=6$ $\qquad$ $11-6=5$
6. $12-5=7$ $\qquad$ $12-7=5$
7. $13-5=8$ $\qquad$ $13-8=5$
8. $14-5=9$ $\qquad$ $14-9=5$
9. $15-5=10$ $\qquad$ $15-10=5$

10. $8-6=2$ $8-2=6$

11. $9-6=3$ $9-3=6$

12. $10-6=4$ $10-4=6$

13. $11-6=5$ $11-5=6$

14. $12-6=6$

15. $13-6=7$ $13-7=6$

16. $14-6=8$ $14-8=6$

17. $15-6=9$ $15-9=6$

18. If you buy a magazine for five cents, and two newspapers for a cent apiece, and pay for them with two nickels, how much change will you receive?

19. If you take two quarts from a peck of shelled corn, how many quarts will be left?

20. On Arbor day a school planted six maple trees, four Japanese ginkgoes, and two elms, and removed seven old cottonwoods. How many more trees has it now, than before?

21. The flag has thirteen stripes of white and of red, and six of them are white. How many of them are red?

22. After five months of the year have passed, how many months remain?

23. If there are nine members of a committee, and four are absent, how many are present?

24. If you have a quarter and a dime in nickels, and lose two nickels, how many will you have left?

25. If you have fifty cents in nickels, and pay four street-car fares at a nickel each, how many nickels will you have left?

26. There were nine hazel bushes removed from a yard, and three rose bushes planted. How many less bushes are there than there were before?

27. In a school building there are eight portraits of American and British authors. Five of the authors are American. How many are British?

Write, and recite from memory:

1. $9-7=2$ $9-2=7$
2. $10-7=3$ $10-3=7$
3. $11-7=4$ $11-4=7$
4. $12-7=5$ $12-5=7$
5. $13-7=6$ $13-6=7$
6. $14-7=7$
7. $15-7=8$ $15-8=7$

8. $9-8=1$ $9-1=8$
9. $10-8=2$ $10-2=8$
10. $11-8=3$ $11-3=8$
11. $12-8=4$ $12-4=8$
12. $13-8=5$ $13-5=8$
13. $14-8=6$ $14-6=8$
14. $15-8=7$ $15-7=8$

15. $10-9=1$ $10-1=9$
16. $11-9=2$ $11-2=9$
17. $12-9=3$ $12-3=9$
18. $13-9=4$ $13-4=9$
19. $14-9=5$ $14-5=9$
20. $15-9=6$ $15-6=9$

21. There are ten wickets in a croquet set. When a ball has passed through six, how many wickets remain to be passed through?

22. If Harold is absent from home for a period of six months in the year how many months of the year does he spend at home?

23. A Corporal and seven other soldiers form a squad. What does a squad lack of a dozen soldiers?

24. Roy had eleven dollars in the postal savings bank, and drew out three dollars, and then three more. How much had he left on deposit?

25. Of fifteen gas jets in a dwelling, eight had mantles. How many were without mantles?

26. There are ten pins in a bowling alley. When a clubman laughingly said, "all down but nine, "how many did he mean he had knocked down?

27. Pauline had seven music records, and bought five more, but has lent four of them. How many has she to play at present?

28. Four dimes and seven dimes less three dimes are how many dimes?

29. If you change a half-dollar into nickels, and lose two nickels, how many nickels will you have?

30. Robert is 10 years old and his father is 40 years old. What is the difference in their ages?

31. Johnnie Careless went to market with fifteen eggs. On the way to market six eggs were broken. How many unbroken eggs had Johnnie to sell?

Write, and recite from memory:

1. $14-12=2$ $\qquad$ $14-2=12$
2. $15-12=3$ $\qquad$ $15-3=12$
3. $16-14=2$ $\qquad$ $16-2=14$
4. $17-14=3$ $\qquad$ $17-3=14$
5. $18-14=4$ $\qquad$ $18-4=14$
6. $17-15=2$ $\qquad$ $17-2=15$
7. $18-15=3$ $\qquad$ $18-3=15$

8. $19-15=4$ $\qquad$ $19-4=15$
9. $18-16=2$ $\qquad$ $18-2=16$
10. $19-16=3$ $\qquad$ $19-3=16$
11. $20-16=4$ $\qquad$ $20-4=16$
12. $19-17=2$ $\qquad$ $19-2=17$
13. $20-17=3$ $\qquad$ $20-3=17$
14. $21-17=4$ $\qquad$ $21-4=17$

15. $20-18=2$ $\qquad$ $20-2=18$
16. $21-18=3$ $\qquad$ $21-3=18$
17. $22-18=4$ $\qquad$ $22-4=18$
18. $21-19=2$ $\qquad$ $21-2=19$
19. $22-19=3$ $\qquad$ $22-3=19$
20. $23-19=4$ $\qquad$ $23-4=19$
21. $24-19=5$ $\qquad$ $24-5=19$

How much is:

1. $20-3$ $\qquad$ $22-18$ $\qquad$ $17-15$
2. $19-4$ $\qquad$ $20-17$ $\qquad$ $22-4$
3. $14-12$ $\qquad$ $17-3$ $\qquad$ $18-14$
4. $22-19$ $\qquad$ $18-15$ $\qquad$ $24-5$
5. $19-16$ $\qquad$ $21-17$ $\qquad$ $17-15$

$$\begin{array}{r} \mathbf{8} \\ \underline{\mathbf{6}} \\ \mathbf{2} \end{array}$$

What is the minuend?

What is the subtrahend?

What is the difference?

Perform the subtractions indicated below, and read the differences?

1.	2.	3.	4.	5.	6.	7.	8.
60	47	98	17	29	74	99	82
30	17	54	10	8	63	88	51

$$\begin{array}{r} \mathbf{35} \\ \underline{\mathbf{16}} \end{array}$$

What is the minuend?

What is the subtrahend?

What is the number in units' column in each?

Can you subtract 6 from 5?

Let us separate the minuend by taking away one ten and adding it to the units.

3 tens and five units = 2 tens and 15 units.

How can we subtract the numbers?

$$\begin{array}{l} \text{2 ten and 15 units} \\ \underline{\text{1 ten and \ 6 units}} \\ \text{1 ten and \ 9 units, or 19} \end{array}$$

We need not write out this separation, but we can make it in our minds, by calling the 5 "fifteen," and calling the 3 "two."

$$\begin{array}{r} \mathbf{35} \\ \underline{\mathbf{16}} \\ \mathbf{19} \end{array}$$

This is sometimes called "carrying back a ten to the units."

Perform the subtractions indicated below:

1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**
23	32	64	87	96	45	53	71
5	3	15	8	7	24	25	2

Add the subtrahend and the difference in each of these problems. If your work is correct, this sum will be equal to the minuend.

$$\begin{array}{r} \mathbf{122} \\ \underline{\mathbf{91}} \end{array}$$

What is the figure in tens' place in the minuend?

What is the figure in tens' place in the subtrahend?

Can we subtract 9 tens from 2 tens?

Let us separate the minuend.

1 hundred and 2 tens and 2 units = 12 tens and 2 units.

Now we can subtract the numbers.

This is sometimes called "carrying back a hundred to the tens." Numbers in all the higher places of figures can be "carried back" in the same way.

$$\begin{array}{l} \text{12 tens and 2 units} \\ \underline{\text{9 tens and 1 unit}} \\ \text{3 tens and 1 unit, or 31} \end{array}$$

Perform the subtractions indicated below; and prove that your work is correct, by adding the subtrahend and the difference in each.

9.	10.	11.	12.	13.	14.	15.	16.
261	536	127	100	200	200	205	100
152	240	8	91	182	10	6	1

17. A man lost $985.00 by fire, and $600.00 of this amount was covered by fire insurance. What was his uncovered loss?

18. If a man is charged $600.00 for an automobile and is allowed $69.60 for repairs made by him, what has the automobile cost him in cash?

19. A man receives $450.00 in rent. His taxes, repairs, and insurance on the building rented, amount to $150.00. What amount is left from the rent?

20. In a certain transaction, a company gains $2,650.00. In another it loses $315.50. How much does it gain in the transactions?

21. A contractor gained $200.00 on one contract, and lost $250.00 on another. How much did he lose on the contracts?

22. The Columbian Exposition was held in Chicago, in 1893. How many years ago was that?

23. Abraham Lincoln died in 1865, when he was fifty-six years old. In what year was he twenty-one?

24. If a man owes $18.62, and makes payment with two ten-dollar bills, how much change will he receive?

1. From 5,642 subtract 5,421.
2. From 4,200 subtract 125.
3. From 1,000 subtract 725.
4. From 25,000 subtract 24,000.
5. From 12,345 subtract 4,321.
6. From $48.50 subtract $24.25.
7. From $52.50 subtract $0.75.
8. From $240.60 subtract $1.75.
9. From $20,265.25 subtract $19,265.25.
10. From $101.25 subtract $0.26.

11. How do we find the sum of two or more numbers?

12. How do we find the difference between two numbers?

13. What is the minuend?

14. What is the subtrahend?

15. If we add the subtrahend to the difference, what will their sum always equal?

16. How many are 2 and 3 and five less eight?

17. 12 less 8 equals how many? Add the subtrahend and the difference.

18. If you have 5 cents and 3 cents and 4 cents, and spend 5 cents, how much money have you left?

19. A quarter* and two dimes and five cents can be exchanged for how many nickels?

20. If you pay two nickels for carfare, and one for a telephone message, and three for a lunch, how much money will you have spent?

---

*Count the quarter as five nickels, and the dime as two nickels.

See Note on page 55.

1. If a cash register shows $16.50 when a shop opens, and $198.50 at the close of the day, how much has been paid in, above what has been paid out?

2. Light is made up of seven colors. If a leaf on which the light falls gives back only the green color, how many colors does it absorb?

3. The author of "Ten Acres Enough" owned eleven acres, and used ten of them for raising crops. How much land had he left for his house and barn and pasture and lawn?

4. The raising of field crops of clover and turnips began in England in 1650. How long ago was that?

5. Old Parr died in 1635. If he was then one hundred fifty-two years old, as is claimed, in what year was he born?

6. A clerk addressed ninety-seven envelopes to towns in Missouri (Mo.); but he wrote the *Mo.* so poorly that only sixty-three went to the right State, and the rest were sent to Maine (Me.). How many were missent?

7. A clerk wrote Ind. (Indiana) on forty-three circulars; but he was so careless that fourteen of them were supposed to be addressed to Md. (Maryland). How many of the addresses were correctly read?

8. How many letters are there in our alphabet? If there were three less, what would the number be?

9. Of nine boys swimming a race, four use the Trudgen, or overhand, stroke and the others use the common stroke. How many use the common stroke?

10. Indiana has ninety-two counties, and Ohio has eighty-eight. Ohio has how many less than Indiana.

11. Out of every hundred farmers in Denmark, eighty-nine own their own farms, and the rest are tenants. How many tenant farmers are there on a hundred farms?

12. In 1731 Jethro Tull introduced the practice of sowing crops in rows wide enough apart for a horse to walk between, and "cultivate" them. How long ago was that?

13. The cotton gin was invented in 1793. How long ago was that?

14. A planter has excluded from cultivation ten acres of coppice and thirty acres of forest trees. How many acres has he excluded in all? If his entire plantation includes three hundred thirty acres, how many acres has he left for cultivation?

15. Sequoyah, who invented the Cherokee Indian alphabet, and discovered the immense Sequoia trees of California, died in 1843. If he was born in 1770, how long did he live?

MULTIPLICATION

FOUR TWOS ARE EIGHT

Here the number two is *multiplied* by four, because *four* twos are combined to make a new number. The new number is called the *product.*

We can find the new number by addition, in this way:

$$\begin{array}{r}2\\2\\2\\\underline{2}\\8\end{array}$$

But as we know the product, we do not need to add the twos, and thus we save time.

It is very necessary to learn the multiplication table, for this reason.

Four 2's are 8
Two 4's are 8.

Does it make any difference which number comes first, when two numbers are multiplied? Are *two fours* the same as *four twos?*

The two numbers multiplied together are called the *factors* of the product.

Multiplication, in Arithmetic, is using numbers as factors. The sign of Multiplication is ×.

Copy and read in turn:

1.	Two 1's are 2	Once two is 2
2.	Two 2's are 4	
3.	Two 3's are 6	Three 2's are 6
4.	Two 4's are 8	Four 2's are 8
5.	Two 5's are 10	Five 2's are 10
6.	Two 6's are 12	Six 2's are 12
7.	Two 7's are 14	Seven 2's are 14

Recite from memory.

8. How many are three 2's? Two 4's?

9. How many are five 2's? Two 6's?

10. How many are seven 2's? Two 3's?

11. How many are four 2's? Two 5's?

12. How many are six 2's? Two 4's?

13. What will be the cost of six two-cent postage stamps?

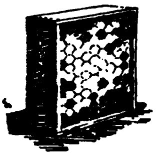
14. How many shoes are there in seven pairs?

15. A triangle is a figure of three sides. How many sides are there in two triangles?

16. How many cents are there in two nickels?

17. The moon revolves about the earth in four weeks. In how many weeks does it revolve twice?

18. A hexagon is a figure of six sides, as in a honeycomb. How many sides are there in two hexagons?



19. Two pounds of honey at 20 cents the pound will cost how much?

19. How many days are there in two weeks?

20. How many acts are there in 2 dramas, if each drama has five acts?

21. In the human body there are seven true ribs on each side. How many are there in all?

22. How many gloves are there in six pairs?

Copy, and read in turn:

1. Two 8's are 16 Eight 2's are 16
2. Two 9's are 18 Nine 2's are 18
3. Two 10's are 20 Ten 2's are 20
4. Two 11's are 22 Eleven 2's are 22
5. Two 12's are 24 Twelve 2's are 24

Recite from memory.

6. How many are eight 2's? Two 11's?
7. How many are two 9's? Twelve 2's?
8. How many are eleven 2's? Two 8's?
9. How many are two 10's? Nine 2's?
10. How many are ten 2's? Two 12's?
11. How many antlers have eight elk?

12. How many lenses are there in twelve pairs of spectacles?

13. A clerk saves $2.00 a week from his salary. How much will he save in eleven weeks?

14. There are eight planets. If each one had two moons, how many moons would there be?

15. How many players are there in two baseball teams of nine members each?

16. A certain house has two stories, with seven windows in each. How many windows are there in all?

17. Nine houses have two chimneys each. How many chimneys are there?

18. A student works eleven months in a year. How many months does he work in two years?

19. There are five bones in the human wrist. How many bones does a person have in his wrists?

Copy, and read in turn:

Three 3's are 9.

1.	Three 4's are 12	Four 3's are 12
2.	Three 5's are 15	Five 3's are 15
3.	Three 6's are 18	Six 3's are 18
4.	Three 7's are 21	Seven 3's are 21

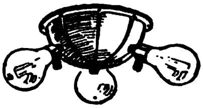
Recite from memory.

5. How many are six 3's? Three 7's?
6. How many are three 4's? Five 3's?
7. How many are seven 3's? Three 6's?
8. How many are three 5's? Four 3's?
9. How many days are there in three weeks?
10. How many are there in five weeks?

11. How many horseshoes are required to shoe three horses?

12. The hard pine of Georgia has three needles in a bunch. How many needles are there in five bunches?

13. How many sides do three hexagons have?



14. Six chandeliers have three electric light bulbs apiece. How many bulbs are there in all?

15. Eight tables in a restaurant have plates for three persons each. How many plates have they in all?

16. The soft white pine of the North has five needles in a bunch. How many are there in three bunches?

Write, and read in turn:

1. Three 8's are 24   Eight 3's are 24
2. Three 9's are 27   Nine 3's are 27
3. Three 10's are 30   Ten 3's are 30
4. Three 11's are 33   Eleven 3's are 33
5. Three 12's are 36   Twelve 3's are 36

Recite from memory.

6. How many are three 11's? Nine 3's?
7. How many are eight 3's? Three 10's?
8. How many are three 9's? Eleven 3's?
9. How many are twelve 3's? Three 9's?
10. How many are three 12's? Ten 3's?
11. How many eggs are there in three dozen?
12. How many quarts are there in three pecks?
13. If there are eight houses in each of three blocks in a village, how many are there in all?
14. If we count nine members to a family, how many members are there in three families?

15. If a Northern harbor is closed by ice for three months in the year, how many months is it closed in eleven years?

16. If there are three volumes in a set, how many volumes are there in nine sets?

Write, and read in turn:

1. Four 4's are 16
2. Four 5's are 20 Five 4's are 20
3. Four 6's are 24 Six 4's are 24
4. Four 7's are 28 Seven 4's are 28
5. Four 8's are 32 Eight 4's are 32
6. Four 9's are 36 Nine 4's are 36
7. Four 10's are 40 Ten 4's are 40
8. Four 11's are 44 Eleven 4's are 44
9. Four 12's are 48 Twelve 4's are 48

Recite from memory.

10. How many are four 8's? Six 4's?
11. How many are seven 4's? Four 9's?
12. How many are four 5's? Eight 4's?
13. How many are nine 4's? Four 4's?
14. How many are four 7's? Four 6's?
15. How many are four 12's? Eleven 4's?
16. How many dimes are there in four dollars?

17. If a man earns $4.00 a working day, how much does he earn in a week?

18. A building nine stories high has four suites of offices in each story. How many suites are there in the building?

19. If a castle has four towers, and each tower has eight windows, how many windows have they all?

20. There are eight squares in a row on a checkerboard. How many squares are there in four rows?

21. The term of the President is four years. How many years are there in six terms?

22. There are four pecks in a bushel. How many pecks are there in eight bushels?

23. Six feet make a fathom. How many feet are there in four fathoms?

24. If four men invest $5,000 each in a mill, how much does the mill cost them?

25. A camping party of school boys have three tents, and for each tent there are sixteen tent pins to be driven into the ground. How many tent pins are there in all?

26. There are seven kinds of golf clubs in a set. How many are there in four sets?

27 How many spokes are there in an ordinary wagon wheel? In the wheels of four wagons?

28. The chanter of a Scotch bagpipe, on which the tune is played, has eight holes, each giving forth a musical note. How many holes have the chanters of four such bagpipes?

29. If a motor boat has a speed of ten miles an hour, how far will it go in four hours?

Write, and read in turn:

1. Five 5's are 25
2. Five 6's are 30 — Six 5's are 30
3. Five 7's are 35 — Seven 5's are 35
4. Five 8's are 40 — Eight 5's are 40
5. Five 9's are 45 — Nine 5's are 45
6. Five 10's are 50 — Ten 5's are 50
7. Five 11's are 55 — Eleven 5's are 55
8. Five 12's are 60 — Twelve 5's are 60

Recite from memory.

9. How many are five 9's? Eleven 5's? Five 7's?

10. How many are seven 5's? Five 12's? Eight 5's?

11. How many are five 6's? Twelve 5's? Five 8's?

12. How many are six 5's? Five 5's? Five 11's?

13. How many are five 10's? Nine 5's? Five 12's?

14. In 1789 there were only twelve States in the Union. There are now four times as many. How many States are there now?

15. How many members are needed for five baseball teams of nine members each?

16. Seven nickels are equal to how many cents?

17. An octagon barn has eight sides. How many sides do five such barns have in all?

18. Five dozen eggs and six eggs more are how many eggs?

19. If there are three generations in a century, how many generations are there in three centuries? —in five times three centuries?

20. A checkerboard has eight rows of squares, with eight squares in each row. How many squares are there in five rows?

21. If a tile walk is five tiles wide, and twelve tiles long, how many tiles does it have?

22. If there are ten autobuses, each carrying five passengers and a chauffeur, how many persons are carried?

23. The ancient Greeks called a period of four years an Olympiad. How many years were there in five Olympiads?

24. If a pair of shoe strings costs a nickel, how many cents will ten pairs cost?

25. A starfish has five points, called "fingers." How many such fingers do five starfishes have?

26. A surrey is a pleasure carriage having two seats. How many seats, in all, do five surreys have? If each seat holds two persons, how many persons will the five surreys hold?

27. At one time, in Holland, a tulip bulb sold for ten thousand dollars. At that rate what would be the cost of five tulip bulbs?

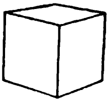
28. Harry helped his uncle Charles pick five bushels of golden russet apples from each of six trees. How many bushels did they pick in all?

Write, and read in turn:

1. Six 6's are 36
2. Six 7's are 42 Seven 6's are 42
3. Six 8's are 48 Eight 6's are 48
4. Six 9's are 54 Nine 6's are 54
5. Six 10's are 60 Ten 6's are 60
6. Six 11's are 66 Eleven 6's are 66
7. Six 12's are 72 Twelve 6's are 72

Recite from memory.

8. How many are six 9's? Twelve 6's? Six 11's?
9. How many are six 8's? Nine 6's? Six 7's?
10. How many are six 6's? Six 12's? Eight 6's?
11. How many are eleven 6's? Seven 6's? Six 12's?



12. How deep is a lake which measures twelve fathoms?

13. A cube has six faces. How many faces do seven cubes have?

14. A knot means about a mile an hour, at sea. If a ship sails at twelve knots for six hours, about how far does it go?

15. Twenty things make a score. Some centipedes have two score legs. How many score of legs do three such centipedes have? How many do a dozen times three have?

16. The black bass has seven fins, counting the tail a fin. How many fins do seven black bass have?

Write, and read in turn:

1. Seven 7's are 49
2. Seven 8's are 56 Eight 7's are 56
3. Seven 9's are 63 Nine 7's are 63
4. Seven 10's are 70 Ten 7's are 70
5. Seven 11's are 77 Eleven 7's are 77
6. Seven 12's are 84 Twelve 7's are 84

Recite from memory.

7. How many are eight 7's? Seven 12's? Nine 7's?

8. How many are eleven 7's? Seven 9's? Ten 7's?

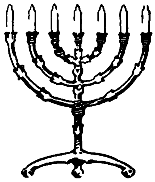
9. How many are twelve 7's? Seven 11's?

10. How many are seven dozen?

11. How many days are there in eleven weeks?—in eight weeks?

12. Four 11's and three 11's are how many?

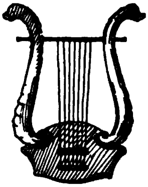
13. There were seven sockets in the great candlestick of the Jews. When a dozen candles had been burned in each, how many had been burned?



14. There are four dozen stars in the flag. How many dozen stars must be made for three flags?—for seven times three flags?

15. How many inches are there in seven feet?

16. Four inches make one hand. How tall is a colt which measures twelve hands in height?



17. The ancient lyre had seven strings. How many strings did eight lyres have?

18. If nine children are each seven years of age, what is the sum of their ages, told by multiplication?

19. If nine dwellings have each seven rooms, how many rooms are there in all?

20. Nine inches make a span. How many inches are there in seven spans?

21. If there are nine players in a base ball team, how many players would there be in seven base ball teams?

Write, and read in turn:

1.	Eight 8's are 64	
2.	Eight 9's are 72	Nine 8's are 72
3.	Eight 10's are 80	Ten 8's are 80
4.	Eight 11's are 88	Eleven 8's are 88
5.	Eight 12's are 96	Twelve 8's are 96
6.	Nine 9's are 81	
7.	Nine 10's are 90	Ten 9's are 90
8.	Nine 11's are 99	Eleven 9's are 99
9.	Nine 12's are 108	Twelve 9's are 108

Recite from memory.

10. How many are nine 8's? Eight 12's? Twelve 8's?

11. How many are eleven 8's? Eight 9's? Eight 8's?

12. How many are twelve 8's? Eleven 8's? Ten 8's?

13. How many are nine 12's? Nine 9's? Twelve 12's?

14. How many are ten 9's? Eight 10's? Eleven 9's?

15. How many are nine dozen?

16. How many inches are there in eight feet?

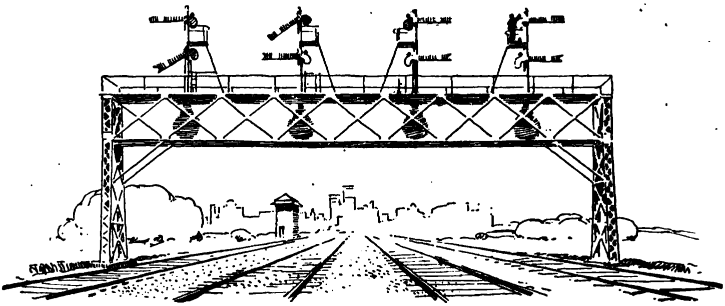
17. How many citizens are there in eight juries of twelve each?

18. How many squares are there in a checkerboard?

19. In a piano there are eight white keys to an octave. How many would there be in a seven-octave piano if no keys were counted twice?

20. There are twelve months in the year. How many are there in eight years? In nine years?

21. How many inches are there in nine spans?



22. On a gantry over railway tracks, there are four semaphores, and each semaphore can give two night signals. How many night signals can be given from seven such gantries?

23. If a railway grade rises seven feet for every mile, how high will it rise in twelve miles?

24. If a coat of a certain pattern requires nine buttons, how many buttons will eight such coats require?

25. If we count a lifetime as seven decades, how many decades will there be in nine lifetimes?

26. The legs and pincers of a lobster are ten in number. How many do nine lobsters have?

27. Nine ships pass an island at sea, and two of them have no wireless. If each of the others sends a message of twelve words, how many messages are received at the island station? How many words?

28. John O'Groat's house had eight doors. If each door was made of eight pieces of wood, how many pieces were used in them?

Write, and read in turn:

1. Ten 10's are 100
2. Ten 11's are 110 Eleven 10's are 110
3. Ten 12's are 120 Twelve 10's are 120
4. Eleven 11's are 121
5. Eleven 12's are 132 Twelve 11's are 132
6. Twelve 12's are 144

Recite from memory.

7. How many are ten 12's? Twelve 11's? Eleven 12's?

8. How many are twelve 10's? Ten 11's? Twelve 12's?

9. How many are ten 10's? Eleven 10's? Eleven 11's?

10. Land is measured by surveyors' chains. Ten square chains make one acre of land. How many square chains are there in ten acres?

11. Twelve dozen things are called a gross. How many things are there in a gross?

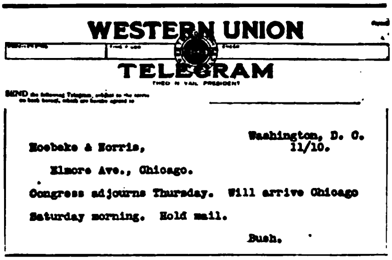
12. In a class there are eleven boys, each eleven years old. What is the sum of their ages, told by multiplication?

13. How many are eleven dozen?

14. How many are three 4's multipled by six 2's?

15. How many are two 5's multiplied by four 3's?

16. If a room is rented for ten dollars a month, what will be the rent for a year?



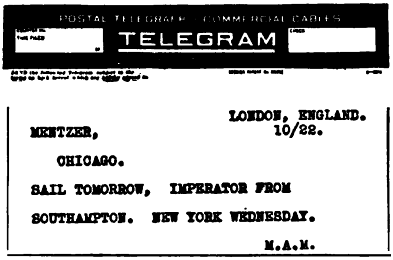
WESTERN UNION
TELEGRAM
THEO. N. VAIL, PRESIDENT

Washington, D. C.
11/10.

Noebeke & Norris,
Elmore Ave., Chicago.

Congress adjourns Thursday. Will arrive Chicago Saturday morning. Hold mail.

Bush.



POSTAL TELEGRAPH — COMMERCIAL CABLES
TELEGRAM

LONDON, ENGLAND.
10/22.

MENTZER,
CHICAGO.

SAIL TOMORROW, IMPERATOR FROM SOUTHAMPTON. NEW YORK WEDNESDAY.

M.A.M.

17. If a dozen telegrams of ten words each are sent, how many words are sent?

18. If ten cablegrams of seven words each are sent, how many words are sent?

19. If I send ten packages by parcel post, and each package must have six two-cent stamps, what will the stamps cost me?

20. If in an orchard there are twelve trees in each row and there are seven rows of apple trees and four rows of pear trees, how many trees are there in all?

Twelve rows of square inches, twelve in a row, make a square foot. Draw a figure to represent a square foot, divided into inches, using any convenient length.

21. How many square inches are there in a square foot?

Draw a border one foot wide around the square foot.

22. How many square feet are there now? How many square inches?

23. How long and how broad is the new square?

$$\begin{array}{r} \mathbf{32} \\ \mathbf{3} \\ \hline \mathbf{96} \end{array}$$

The upper number is called the *multiplicand*, which means *the number to be multiplied.*

The lower number is the *multiplier*.

The *product* of the two numbers is written below the line.

Read the multiplicand.

What number is the multiplier? Read the product. What figure is first multiplied, and what is the product? In what place is this product written?

What figure is next multiplied? What is the product? Where is this product written?

Read the product for both figures.

$$\begin{array}{r} \mathbf{25} \\ \mathbf{3} \\ \hline \mathbf{75} \end{array}$$

What is the figure in units' place in the multiplicand? How many are three 5's?

Can we write 15 units in units' place? 15 units are one ten and how many units? What is written in units' place? To what place must the ten be carried?

Three 2's in tens place are how many 10's?

Adding the one ten that was to be carried, we have how many 10's in the product?

Copy these problems, and perform the multiplications:

1.	**2.**	**3.**	**4.**	**5.**
125	264	173	103	227
2	3	4	6	9

6.	**7.**	**8.**	**9.**	**10.**
314	420	500	1,012	10,324
8	7	4	6	6

$$\mathbf{2 \times 10 = 20}$$

> *To multiply any number by ten, we need only to add a cipher, because this will move it to the next higher place or places of figures. To multiply it by one hundred add* **two** *ciphers; etc.*

What is the product of 5×10? Of 50×10?
What is the product of 100×10? Of 10×10?
What is the product of 1,025×10? Of 1,000×10?

$$\begin{array}{r} \mathbf{34} \\ \underline{\mathbf{22}} \\ \mathbf{68} \\ \underline{\mathbf{68}} \\ \mathbf{748} \end{array}$$

What is the multiplicand?

What is the multiplier?

Multiplying by one figure at a time, we have two *partial products*. What are they?

We add the partial products to make the complete product. Read it.

We must note that the first figure of a partial product **is always written under its own multiplier.**

What is the first figure written in the partial product? Under what is it written? What is the first figure of the second partial product? Under what figure of the multiplier is it written?

$$\begin{array}{r} 124 \\ \underline{346} \\ 744 \\ 496 \\ \underline{372} \\ 42{,}904 \end{array}$$

There are how many figures in the multiplier? How many are there in the partial products? Read the first partial product. —the second. —the third.

Read the complete product.

$$\begin{array}{r} 236 \\ \underline{102} \\ 472 \\ \underline{236} \\ 24{,}072 \end{array}$$

How many figures are there in the multiplier, not counting the cipher as a figure?

Why are there only two partial products?

Read the complete product.

$$\begin{array}{r} 29 \\ \underline{12} \\ 348 \end{array}$$

What is the multiplier?

How many places of figures has it?

Are there any partial products?

We might multiply first by *two* and then by *one*, and have two partial products. But since we have learned the multiplication table up to twelve, it is not necessary here to have partial products, and it saves time and work to multiply both figures of the mulplicand by twelve at once. In the same way, when we multiply a number by 11, we should do without partial products.

Multiply the following numbers successively by 3, by 5, and by 8.

1. 340
2. 565
3. 245
4. 311
5. 410
6. 514
7. 392
8. 619

Multiply the following numbers successively by 10, by 11, and by 15.

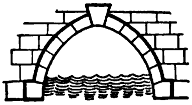
1. 436
2. 724
3. 239
4. 373
5. 782
6. 496
7. 839
8. 542

Multiply the following numbers successively by 21, by 32, and by 60.

1. 422
2. 694
3. 819
4. 763
5. 573
6. 617
7. 399
8. 815

Multiply the following numbers successively by 215 and by 320.

1. 962
2. 678
3. 896
4. 942



1. How many stones are there in this arch? How many would there be in three such arches?

2. The arm has one bone from the shoulder to the elbow, and two bones from the elbow to the wrist. How many of these bones do three persons have in all?

3. The mariner's compass shows four cardinal points—north, east, south and west. Besides these, it has seven points in each of the four quarters. How many points has it in all?

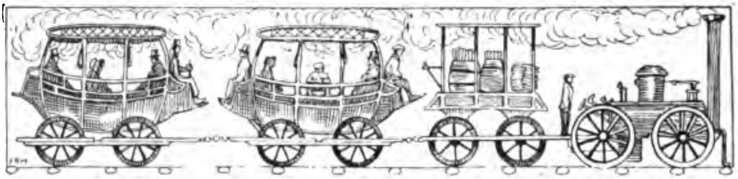
4. The chevron on the sleeve of a corporal has two bars, while the chevron on the sleeve of a sergeant has three. How many bars have the chevrons on all the sleeves of two corporals and three sergeants?

5. Three rows of square feet, three in a row, make a square yard. Draw a square yard, and mark the feet in it. How many square feet has it?

6. Draw a border one foot wide around the square yard, and divide it into feet. How many square feet are there in the border? How many are there in the whole drawing?

7. In fable, the mermaids living under the sea have each a mirror and a red comb, for dressing their green hair. How many mirrors and combs, would seven mermaids have?

8. If a corn planter drops four grains of corn in each hill, how many grains will he drop in twelve hills?



8. Here is a picture of a railway train of less than a century ago. How many men do you see?

9. How many wheels can you see? How many spokes has one of the carriage wheels?

10. How many spokes are there in the train?

11. How many fingers do the men have? How many fingers and toes?

12. A spring is one hundred feet from a summer cottage in the mountains, and water has to be carried from it in buckets to the cottage. In carrying the water three times a day for seven days, how many hundred feet does the cottager have to walk?

13. How many ears are there on the stalks of corn in one hill that you have examined? How many would there be in a row of forty such hills?

14. There are 160 square rods in an acre. How many are there in ten acres?—in five acres?

15. If the boll weevil caused a loss of 400,000 bales of cotton each year for eight years in the United States, what was the entire loss for that time?

Note—The statement on page 50 regarding the *Combinations in Addition* is equally applicable to *Multiplication.* Unless the pupil has a ready use of the *Combinations in Addition*, and the *Multiplication of numbers up to 12*, he will be seriously handicapped in all his subsequent mathematical study; hence it is important that these be mastered before other work is taken up.

DIVISION

IN EIGHT THERE ARE FOUR TWOS

Here it is shown that 8 is made up of four 2's, and 2 can be taken from it four times continuously.

It can be shown by subtraction in this way:

$8-2=6, \qquad 6-2=4, \qquad 4-2=2, \qquad 2-2=0.$

Here 2 has been taken from 8 four times continuously, and there is nothing left.

> *Division is a short way of finding how many times one number can be continuously taken from another. The sign of Division is ÷*

The number to be divided is called the *dividend.* The number by which it is divided is called the *divisor.*

The sign is called the *sign of division,* and is placed between two numbers to show that the first is to be divided by the second.

The new number found by division is called the *quotient.*

$$8 \div 2 = 4$$

This is to be read, *Eight divided by two equals four.* 8 is the dividend, 2 is the divisor, and four is the quotient.

$$8 \div 4 = 2$$

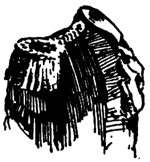
What is the dividend? What is the divisor? What is the quotient?

Copy, and read in turn:

1. In 4 there are two 2’s.
2. In 6 there are two 3’s, or three 2’s.
3. In 8 there are two 4’s, or four 2’s.
4. In 10 there are two 5’s, or five 2’s.
5. In 12 there are two 6’s, or six 2’s.
6. In 14 there are two 7’s, or seven 2’s.
7. In 16 there are two 8’s, or eight 2’s.
8. In 18 there are two 9’s, or nine 2’s.
9. In 20 there are two 10’s, or ten 2’s.
10. In 22 there are two 11’s, or eleven 2’s.
11. In 24 there are two 12’s, or twelve 2’s.

Recite from memory.

12. How many 2’s are there in 18? In 14? In 16?
13. In 18 there are how many 2’s? How many 9’s?
14. How many 2’s are there in 22? In 8? In 24?
15. In 16 there are how many 2’s? How many 8’s?
16. How many 2’s are there in 20? In 6? In 12?
17. Twenty-four gloves are how many pairs?
18. Fourteen days are how many weeks?
19. When a number is divided by two, the quotient is called one-half, which is written: $\frac{1}{2}$.
20. What is one-half of twelve? Of twenty-four?



21. If one officer wears two epaulettes, how many officers will six epaulettes supply?

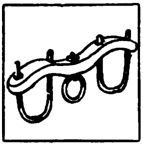
22. If Harry earns two dimes a day, in how many days will he earn eighteen dimes?

23. How many quarts are there in sixteen pints?

24. For how many pairs of spectacles will fourteen lenses be needed?

25. For how many stuffed birds will a taxidermist need ten glass eyes?

26. A fortnight is two weeks. How many fortnights are there in twenty-two weeks?



27. A yoke answers for two oxen. How many yokes will be needed for twelve oxen?

28. It is fourteen miles from one railway station to another. When a train has gone half the way, how far is it from each?

Write, and read in turn:

1. In 9 there are three 3's.
2. In 12 there are four 3's, or three 4's.
3. In 15 there are five 3's, or three 5's.
4. In 18 there are six 3's, or three 6's.
5. In 21 there are seven 3's, or three 7's.
6. In 24 there are eight 3's, or three 8's.
7. In 27 there are nine 3's, or three 9's.
8. In 30 there are ten 3's, or three 10's.
9. In 33 there are eleven 3's, or three 11's.
10. In 36 there are twelve 3's, or three 12's.

Recite them from memory.

11. How many 3's are there in 18?—in 12?—in 24?

12. In 27 are how many 3's? How many 9's?

13. How many 3's are there in 15?—in 36?—in 33?

14. In 24 are how many 3's? How many 8's?

15. How many 3's are there in 33?—in 27?—in 12?

16. When a number is divided by three, the quotient is called one-third of it. One-third is written thus: $\frac{1}{3}$.

What is one-third of eighteen?—of twenty-four?

17. There are three months in a season. How many seasons are there in a year?

18. Thirty-six eggs are how many dozen eggs?

19. If a furniture dealer buys a table for twelve dollars, and sells it for one-third more, what does he sell it for?

20. If he sells it for one-third less than he paid for it, how many dollars does he lose?

21. A man becomes a voter at the age of twenty-one. How old is he at one-third of that age?

22. A league is three miles. A ship thirty-three miles distant is how many leagues away?

23. There are twenty-four hours in a day and night. If a person takes one-third of this time for rest and sleep, how many hours does he take?

24. Philip is eighteen years old, and his brother is two-thirds as old. How old is the brother?

25. If I have twenty-one candles, how many will there be for each of seven candlesticks?

Copy, and read in turn:

1. In 16 there are four 4's.
2. In 20 there are five 4's, or four 5's.
3. In 24 there are six 4's, or four 6's.
4. In 28 there are seven 4's, or four 7's.
5. In 32 there are eight 4's, or four 8's.
6. In 36 there are nine 4's, or four 9's.
7. In 40 there are ten 4's, or four tens.
8. In 44 there are eleven 4's, or four 11's.
9. In 48 there are twelve 4's, or four 12's.

Recite them from memory.

10. How many 4's are there in 32? In 16? In 48?
11. In 28 there are how many 4's? How many 7's?
12. How many 4's are there in 36? In 44? In 32?
13. In 28 there are how many 4's? How many 7's?
14. How many 4's are there in 40? In 24? In 16?

15. When a number is divided by four, the quotient is called a *quarter*, or a *fourth*, which is written thus: $\frac{1}{4}$.

What is one-fourth of thirty-six? Of twenty-eight?

16. The President's term of office is four years. How many such terms are there is sixteen years? In twenty-four years?

17. How many dozen loaves of bread are there in forty-eight loaves?

18. Of two dozen prisoners, one-third escaped from jail. How many were left?

19. Once in four years there is a leap year, one day longer than the others. How many leap years are there in forty-eight years?

20. The term of a United States senator is six years. If a senator serves for thirty years, how many terms does he serve?

21. How many feet are there in forty-eight inches?

22. If a man sets out twenty-four plants, and three quarters of them grow, how many does he have growing?

23. If the spaces between fence posts are eleven feet, how many spaces will there be in sixty-six feet?

24. A surveyor's chain is sixty-six feet long. This is how many times two yards?

Copy, and read in turn:

1. In 25 there are five 5's.
2. In 30 there are six 5's, or five 6's.
3. In 35 there are seven 5's, or five 7's.
4. In 40 there are eight 5's, or five 8's.
5. In 45 there are nine 5's, or five 9's.
6. In 50 there are ten 5's, or five 10's.
7. In 55 there are eleven 5's, or five 11's.
8. In 60 there are twelve 5's, or five 12's.

Recite from memory.

9. How many 5's are there in 45? —in 60? —in 25?
10. In 50 there are how many 5's? How many 10's?
11. How many 5's are there in 35? —in 20? —in 55?

12. In 40 there are how many 5's? How many 8's?

13. How many 5's are there in 30? —in 15? —in 50?

14. When a number is divided by five, the quotient is called *one-fifth*, which is written thus: $\frac{1}{5}$.

What is one-fifth of sixty? —of 45? —of 35?

15. Five girls make forty-five wreathes to decorate a hall. That number is how many for each girl?

16. If Frank earns five dollars a week, in how many weeks will he earn thirty dollars.

17. A man of forty years had spent one-fifth of his life in school. How many years had he been in school? How many out of school?

18. If ten automobiles carry, each, an extra wheel for use in case of accident, how many wheels are there, all told? How many wheels are there for each automobile?

19. Counting five school days to a week, how many weeks must there be for forty-five school days?

20. If shoe strings cost five cents a pair, how many pairs can you buy for sixty cents?

21. There are sixty minutes in an hour. If a certain kind of street car passes every twelve minutes, how many will pass in an hour?

Write, and read in turn:

1. In 36 there are six 6's.
2. In 42 there are seven 6's, or six 7's.
3. In 48 there are eight 6's, or six 8's.

4. In 54 there are nine 6's, or six 9's.
5. In 60 there are ten 6's, or six 10's.
6. In 66 there are eleven 6's, or six 11's.
7. In 72 there are twelve 6's, or six 12's.

Recite from memory.

8. How many 6's are there in 18? In 72? In 36?
9. In 54 there are how many 6's? How many 9's?
10. How many 6's are there in 48? In 66? In 42?
11. In 72 there are how many 6's? How many 12's?
12. When a number is divided by six, the quotient is called one-sixth, which is written thus: $\frac{1}{6}$. What is one-sixth of sixty-six?
13. What is one-sixth of forty-eight? —of fifty-four? —of seventy-two?

Write, and read in turn:

1. In 49 there are seven 7's.
2. In 56 there are eight 7's, or seven 8's.
3. In 63 there are nine 7's, or seven 9's.
4. In 70 there are ten 7's, or seven 10's.
5. In 77 there are eleven 7's, or seven 11's.
6. In 84 there are twelve 7's, or seven 12's.
7. In 64 there are eight 8's.
8. In 72 there are nine 8's, or eight 9's.
9. In 80 there are ten 8's, or eight 10's.
10. In 88 there are eleven 8's, or eight 11's.
11. In 96 there are twelve 8's, or eight 12's.
12. How many 7's are there in 63? In 84? In 21?

Recite from memory.

13. In 77 there are how many 7's? How many 11's?
14. How many 8's are there in 72? In 64? In 96?
15. In 56 there are how many 7's? How many 8's?
16. How many 8's are there in 80? In 88?

Write, and read in turn:

1. In 81 there are nine 9's.
2. In 90 there are ten 9's.
3. In 99 there are eleven 9's.
4. In 108 there are twelve 9's.
5. In 100 there are ten 10's.
6. In 110 there are eleven 10's, or ten 11's.
7. In 120 there are twelve 10's, or ten 12's.
8. In 121 there are eleven 11's.
9. In 132 there are eleven 12's, or twelve 11's.
10. In 144 there are twelve 12's.

Recite from memory.

11. How many 9's are there in 81? In 108? In 99?
12. In 110 there are how many 10's? How many 11's?
13. How many 11's are there in 110? In 132? In 121?
14. Divide 99 by 11.
15. Divide 143 by 11.
16. Divide 132 by 11. —by 12.
17. Divide 121 by 11.
18. Divide 144 by 12.
19. Divide 100 by 10.

There are three ways of showing the division of one number by another. Here is one:

$$8 \div 4 = 2$$

This is read *8 divided by 4 equals 2.*

Which number is the dividend? —the divisor? —the quotient?

Another way is to write the divisor under the dividend, with a horizontal line between them.

$$\frac{8}{4} = 2$$

This also may be read *8 divided by 4 equals 2,* or it may be read *8 fourths equal 2,* or *8 quarters equal 2.*

When the dividend and the divisor are written in this way, they are called a *fraction.*

The old word *fraction* used to mean a *breaking,* as the word *fracture* means to-day, when we speak of the *fracture* of a bone or of a vase.

If a panful of biscuits, eight in number, is broken into four equal parts, there will be two biscuits in each part.

The third way of showing division is this:

$$\begin{array}{r} 4)8 \\ 2 \end{array}$$

Here the divisor is written at the left of the dividend, and the quotient below.

2)246
123

Here each figure of the dividend is divided separately, and the quotient figure is written below.

Perform in this way these divisions:

1.	2.	3.	4.
3)963	4)484	2)846	2)2824

4)808
202

How many 4's are there in eight?

Are there any 4's in tens' place in the dividend?

What do we write in the quotient in tens' place?

Read the quotient.

3)612
204

Are there any 3's in tens' place in the dividend?

What do we write for the quotient figure in tens' place?

What is in tens' place in the dividend?

If we add this ten to the figure in units' place, how many units will there be to divide by 3?

3)378
126

What is the figure in tens' place in the dividend?

In seven there are two 3's, and what number over?

Adding this ten to the figure in units' place, there are how many units to be divided by 3? What is the figure?

Read the quotient.

$$\begin{array}{r} 4\overline{)304} \\ 76 \end{array}$$

What number is in hundreds' place in the dividend? Are there any 4's in it?

A cipher need not be written under it in the quotient, because it would not mean anything at the left of the first number.

$$\begin{array}{r} 4\overline{)521} \\ 130\frac{1}{4} \end{array}$$

What is the figure in hundreds' place? How many 4's are there in 5, and what is the remainder?

How many 4's are there in 12? Are there any 4's in 1?

There is a remainder of 1, which must also be divided by 4, and added to the quotient.

Read the quotient.

Make these divisions:

1. $24 \div 6$
2. $27 \div 3$
3. $48 \div 4$
4. $56 \div 7$
5. $85 \div 5$
6. $96 \div 8$
7. $144 \div 12$
8. $621 \div 3$
9. $4914 \div 6$
10. $2850 \div 5$
11. $4500 \div 9$
12. $2684 \div 4$
13. $5\overline{)1050}$
14. $7\overline{)8477}$
15. $12\overline{)1440}$
16. $11\overline{)1320}$
17. $12\overline{)1455}$
18. $9\overline{)3608}$
19. $\frac{1560}{12}$
20. $\frac{810}{9}$
21. $\frac{648}{8}$

$1000 \div 10 = 100$

When a number that ends in a cipher is to be divided by 10, we have only to cut off the cipher at the right of the dividend; for this will move every figure in the number to the next place to the right. Thousands will become hundreds; hundreds will become tens, tens will become units.

Make these divisions:

1. $200 \div 10$
2. $240 \div 10$
3. $4,000 \div 10$

$70 \div 10$

4. $1,620 \div 10$
5. $32,000 \div 10$
6. $15,150 \div 10$

$90 \div 10$

Cutting off one cipher at the right of a dividend divides the number by **10***; cutting off two ciphers divides it by* **100***; cutting off three ciphers divides it by* **1000***; etc.*

Make these divisions:

7. $4,000 \div 100$
8. $10,000 \div 100$
9. $10,000 \div 1,000$
10. $45,000 \div 100$
11. $15,000 \div 10$
12. $100,000 \div 1,000$
13. $50,000 \div 100$
14. $650,000 \div 10,000$
16. $1,000,000 \div 10$
17. $1,500,000 \div 100$
18. $150,000 \div 1,000$
19. $432,000 \div 100$
20. $874,000 \div 100$
21. $200,000 \div 10,000$
22. $462,000 \div 1,000$
23. $27,000 \div 100$
24. $30,000 \div 1,000$
25. $2,000,000 \div 10,000$

LONG DIVISION

The written division that we have been studying is called *short division,* because the work was not all written. When tens were added to units, or hundreds were added to tens, in the dividend, we did not write the additions, but added the numbers in our minds only.

Where the divisor has two places of figures, it is generally better to have more of the work written.

Where this is done, the work is called *long* division.

The quotient is placed at the right of the dividend, after a line curved outward, or else over it.*

$$\begin{array}{l} 15)375(25 \\ \underline{30} \\ 75 \\ \underline{75} \end{array} \qquad\qquad \begin{array}{r} 25 \\ 15\overline{)375} \\ \underline{30} \\ 75 \\ \underline{75} \end{array}$$

Two figures of the dividend are first used as a *partial dividend.* How many 15's are there in 37?

The number is now written in the quotient. The divisor is multiplied by it, and the product is written under the partial dividend, to be subtracted from it.

What is the product of 15×2? Subtracting this product from 37, what is the difference?

After this 7, the next figure of the dividend is brought down and written in a new partial dividend. What is the figure brought down?

What is the new partial dividend?

---

*Both of these forms are employed. It is left optional with the teacher which to use.

How many 15's are there in 75?

Where is the quotient figure placed?

When the divisor is multiplied by this second quotient figure, what is the product?

When this product is subtracted from the partial dividend, is there any difference remaining?

Read the quotient.

15)3015(201

30

15

15

What is the first partial dividend?

What is the first quotient figure?

What is the product of 15×2?

When this product is subtracted from the partial dividend, is there any difference remaining?

What figure is brought down from the dividend, for the new partial dividend?

Are there any 15's in 1?

What is next written in the quotient?

What figure is next brought down from the dividend for the new dividend?

Are there any 15's in the new partial dividend now? How many? What is next written in the quotient?

25)501(20$\frac{1}{25}$

50

1

What is the first partial divisor?

What figure is brought down for the next partial dividend? Is the divisor contained in it? Since this remaining figure must be divided by the divisor, how is this done? Where is the fraction placed?

Long division is generally used where the divisor contains two or more figures. Where the pupil has mastered the multiplication table, the numbers 11 and 12 may be used as divisors in *short* division, thus saving time and work.

$$\begin{array}{r} 12\overline{)5{,}166} \\ \hline 430\frac{6}{12} \end{array}$$

Solve these problems bv long division:

1. 225 ÷ 15
2. 266 ÷ 19
3. 468 ÷ 18
4. 690 ÷ 15
5. 576 ÷ 24
6. 540 ÷ 45
7. 532 ÷ 38
8. 7,965 ÷ 15
9. 6,020 ÷ 26
10. 5,474 ÷ 14
11. 4,452 ÷ 21
12. 4,962 ÷ 41
13. 6,608 ÷ 64
14. 7,650 ÷ 75
15. 7,250 ÷ 21
16. 8,888 ÷ 44
17. 6,266 ÷ 13
18. 2,940 ÷ 28
19. 9,786 ÷ 13
20. 600,000 ÷ 20
21. 8,760 ÷ 24
22. 9,695 ÷ 95
23. 17,292 ÷ 36
24. 5,960 ÷ 16
25. 5,280 ÷ 32
26. 24,420 ÷ 185
27. 68,250 ÷ 325
28. 12,074 ÷ 22
29. 5,625 ÷ 75
30. 46,089 ÷ 64

The product of the divisor and quotient will equal the dividend if the work is done correctly. Prove your results in the first four problems by this test.

Solve these problems by short division:

1. 217,360 ÷ 11
2. 675,000 ÷ 12
3. 4,801,500 ÷ 11
4. 640,400 ÷ 12

1. Robinson Crusoe and Friday and the Spanish captive fought against twenty-one savages. The savages were how many times the number of these men?

2. If an American flag in 78 inches wide, how many inches wide is each stripe? How many feet wide is the flag?

3. Mr. Jones marks his grain sacks and fruit cases with this stencil:

A B JONES

How many letters does he mark on twelve sacks and twelve fruit cases? If he takes five seconds to mark each one, how much time does he spend in marking them all?

4. If the posts of a fence are six feet apart, how many will be needed to fence a piece of ground thirty-six feet square? Draw a square figure of the ground, and mark the posts.

5. If the posts of a certain fence are ten feet apart, how many will be needed to fence a piece of ground sixty feet long and forty feet wide? Draw a figure of the ground, and mark the places of the posts.

6. If a person has thirty-two teeth, one-half the number in each jaw, how many has he on one side of the jaw?

7. If we could travel toward the moon at the rate of sixty miles an hour, how many hours would it take

us to reach it when it is 238,000 miles distant? How many days would it take?

8. There are 160 square rods in an acre of ground. A certain acre of ground is cut up into lots which are eight rods long and five rods wide. How many such lots are there in it?

9. If an acre lot is ten rods long, how many rods wide is it? If it is eight rods long?

10. A farm of one hundred sixty acres would make how many farms of ten acres each?

11. There are 5280 feet in a mile. If your school building is $\frac{1}{4}$ of a mile from your home, how many steps of two feet each will you take in going to school and returning?

12. If you can write fifteen words a minute with a pen, and by learning to use a typewriter could write sixty-five words a minute, how much time would you save in copying a manuscript containing 9,750 words, by the use of a typewriter?

13. The necessary expenses of a certain man are seven dollars per week. On investigation he finds that his expenses have been twelve dollars per week. In how many weeks could he save $100.00, by permitting only necessary expenses?

14. Mr. Jones divided $6.60 among three boys for extra work in his store. One boy received $\frac{1}{2}$ of the whole amount. Another $\frac{1}{4}$ of the whole amount. How much did the third boy receive?

Sometimes multiplication and division are combined in the same problem, as in the following:

What is the product of $18 \times 2\frac{1}{2}$?

$18 \times 2 = 36$
$18 \div 2 = \underline{\ 9\ }$
$18 \times 2\frac{1}{2} = 45$

What is the product of 18 by 2?
Multiplying by $\frac{1}{2}$ is the same as dividing by 2.
How much is $\frac{1}{2}$ of 18?
What is the answer to the problem?

1. $25 \times 2\frac{1}{5}$
2. $40 \times 3\frac{1}{4}$
3. $75 \times 4\frac{1}{3}$
4. $100 \times 2\frac{1}{5}$
5. $45 \times 2\frac{1}{9}$
6. $25 \times 25\frac{1}{5}$
7. $48 \times 10\frac{1}{2}$
8. $49 \times 5\frac{1}{7}$
9. $64 \times 4\frac{1}{8}$
10. $66 \times 20\frac{1}{6}$
11. $42 \times 15\frac{1}{7}$
12. $18 \times 24\frac{1}{3}$
13. $210 \times 2\frac{1}{2}$
14. $56 \times 24\frac{1}{8}$

15. For two and one-half months a mill earned $36.00 the month. How much did it earn in that period?

16. For four and one-seventh weeks a farmer paid a laborer $14.00 the week. How much did he pay for that period?

17. I bought eight and one-quarter tons of coal at $7.75 the ton. What did the coal cost?

18. A year contains fifty-two and one-seventh weeks. If I save $14.00 each week, how much will I save in a year?

1. In ninety days a toad destroyed 2,160 cutworms. If a farmer was paying a cent apiece to have the cutworms destroyed, what would this toad have been worth to him in that time?

2. There are fifty-two and one-seventh weeks in an ordinary year. If a man saves seven dollars a week, how much will he save in a year?

3. A brick is eight inches long and four inches wide. How many rows of four square inches each are there on one side of it? How many square inches are there on one side of it? Draw figure.

4. Draw a figure of bricks inclosing a space four inches wide and twelve inches long. How many bricks are needed to inclose the space? Does any brick have to be broken?

Show the arrangement of the bricks?

5. Draw a figure of a space four inches wide and eight inches long, inclosed by bricks.

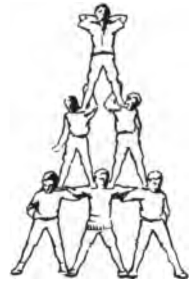
How many bricks are needed to inclose it? Does a brick have to be broken?

Draw a figure showing the arrangement of the bricks.

6. A surveyor's chain has 100 links, and is 66 feet long. How long is each link?

7. A surveyor's chain is four rods long. How many feet are there in a rod?

8. If a farmer builds a little railway twelve rods long, to connect his barns, how many feet of rails has it?



9. How many boys are there in this athletic pyramid? How many fingers have they all? How many fingers and toes? If each boy has 208 bones, how many bones have they all?

10. In the story of Gulliver, the men of Brobdingnag were so tall that one of their steps would measure ten yards. How many feet were there in a step? In two steps?

11. Jack the Giant Killer, in ancient legend, dug a pit one hundred twenty feet wide, for the giant to fall into. How many yards wide was the pit?

12. At a certain station a passenger train of seven coaches leaves a dining coach and two day coaches, and takes on three through sleeping coaches and a private car. How many coaches has it then?

13. If I write a telegram of nine words, and cancel three that are found to be unnecessary, and then add four more, how many words are there? Six telegrams of this size would be how many words?

14. If for ten weeks I deposit in a savings bank three dollars each week, and then for ten months I pay two dollars each week to a building and loan association, how much money do I lay by in all this time?

15. If a Boy Scout does seven good deeds a day for eleven days, and on two occasions three of these are balanced by three demerits each time, how many deeds has he to his credit?

16. If one lot is 100 feet long and 50 feet wide, and another is 150 feet long and 50 feet wide, how long a fence will be needed to inclose each separately? Draw plan.

17. If the two lots join on their long sides, and there is no fence between them, how long a fence will be needed to inclose both? Draw plan.

18. At the Tabard Inn, in London, hundreds of years ago, were nine and twenty pilgrims going to Canterbury. The poet Chaucer and the innkeeper joined them. How many were there in the party?

19. If each had told two tales on the journey, how many tales would have been told? There were only two dozen tales told. How many did this lack of two apiece?

20. If, as stated, there are in Denmark 250,000 farms, and 68,000 of these are of one and one-half acres or less, how many of the farms are larger than this?

21. The author of "Ten Acres Enough" began his farming in 1838. How long ago was that?

22. If Rip Van Winkle, in the old story, awoke from his sleep in the mountains in 1792, after he had slept for twenty years, in what year did he go to sleep?

23. General Washington became our first President in 1789. How long had he been President when Rip Van Winkle awoke from his long sleep, according to the story?

PART II

ROMAN NUMERALS

Before our convenient and beautiful figures were invented, letters were used to mean numbers.

If A had always stood for 1, and B for 2, and C for 3, and D for 4, and so on, it would be easier for us to read the old numbers that were written in letters, so long ago.

But the people of the old Roman Empire, who first taught our people to write numbers, had a very strange plan. A stood for 500, B for 300, C for 100, D (like A) for 500, E for 250, and F for 40. Near the middle of the alphabet, I stood for 1, L for 50, M for 1000. Near the end of the letters, V stood for 5, and X for 10. This was not a good plan. A young pupil to-day can write numbers better than the wisest man in the world could write them in ancient days.

It is not worth while for us to learn *all* the numbers for which letters were used. Only a few of them are now remembered, and these are the ones that were used for dates. The letters were cut in stone on some very old buildings, arches, and monuments which are still standing, and they show when these were built. They are sometimes used in this way to-day on new buildings, to keep up the very old custom.

They are found on the title pages of books, to show when these were printed. Sometimes they are used for the heads of chapters.

Very often you will see them on the faces of clocks and watches.

They are written after the names of kings and queens. When they are so written, they form a part of the title. Thus Henry VIII is read "Henry the Eighth," and *not* Henry Eight. George V is read "George the Fifth."

The letters which are used in this way are called *Roman numerals*. There are only seven of them; but by repeating and combining them, we can use them for any number. These seven letters are C, D, I, L, M, V, and X.

Beginning with the smallest nnmber, copy and read in turn:

1. I = 1.
2. V = 5.
3. X = 10.
4. L = 50.
5. C = 100.
6. D = 500.
7. M = 1000.

Read these letters and numbers in concert.

Recite them from memory.

8. Read these numbers: C, M, V, X, D, L, I.

The use of these seven letters as numbers is remembered, while the use of other letters in like manner is almost forgotten: and few people ever care to learn the numbers represented by the latter.

The seven letters can be combined to represent any number, so that the other letters are not really needed for numbers.

A horizontal line over a letter multiplies the number by 1000. Thus $\overline{\text{V}}$ means 5000.

The letters may be repeated, for the Romans had no *places* of figures such as we have. Here are some of their combinations. Copy and read in turn:

9. II = 2.
10. III = 3.
11. XX = 20.
12. XXX = 30.
13. CC = 200.
14. CCC = 300.
15. MM = 2000.
16. MMM = 3000.
17. $\overline{\text{II}}$ = 2000.

VI = 6

Where a smaller number follows a larger one, it is to be added to it. If the Romans had had places of figures, as we have, VI would mean 51, because the V would be in tens' place, and the I in units' place. But it means only 6.

Copy these combinations, and read in turn.

1. VI = 6.
2. VII = 7.
3. VIII = 8.
4. XI = 11.
5. XII = 12.
6. XIII = 13.
7. XV = 15.
8. XVI = 16.
9. XVII = 17.
10. XVIII = 18.
13. LX = 60.
14. LXX = 70.
15. LXXX = 80.
16. CX = 110.
17. CXX = 120.
18. DC = 600.
19. DCC = 700.
20. DCCC = 800.
21. DCCCC
or CM = 900.

IV=4

Where a smaller number is placed before a larger one, it is subtracted from this:[*] Write, and read in turn:

IV = 4.[†]
IX = 9.
XL=40.
XC=90.

In the queer Roman way, *subtraction must come before addition.*

XIV=14

Here we must first subtract the I from the V, and then we must add their difference to the X.

Copy, and read in turn:

1. I= 1.
2. II= 2.
3. III= 3.
4. IV= 4.
5. V= 5.
6. VI= 6.
7. VII= 7.
8. VIII= 8.
9. IX= 9.
10. X=10.
11. XI=11.
12. XII=12.
13. XIII=13.
14. XIV=14.
15. XV=15.
16. XVI=16.
17. XVII=17.
18. XVIII=18.
19. XIX=19.
20. XX=20.
21. XXI=21.
22. XXII=22.
23. XXIII=23.
24. XXIV=24.
25. XXV=25.
26. XXVI=26.
27. XXVII=27.
28. XXVIII=28.
29. XXIX=29.
30. XXX=30.

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[*] This will account for the occasional use of CM for DCCCC, as given on the preceding page.

[†] On the faces of clocks and watches made in the French fashion, four I's stand for 4. Legend says that an artistic French king, preparing vignettes, or pictures of vines, twining about I, II, and III, for a clock face, became so absorbed that he forgot to stop with III; and also states that he refused to admit his error.

Read these numbers:

1. VIII, XII, XIX, XXIV, XCI.
2. IV, IX, XC, XL, CM.
3. XIV, LIX, CL, MC, DC.
4. DCC, MCCC, MDCCC, MDCCCC, MCM.
5. MCMXIII, CCCXXV, MCCCCXCII, MDCCLXXVI.
6. Read these titles: Charles IX, Mary II, James I, Henry IV, Catherine II, Edward VII, George V, Alphonso XIII, Nicholas II.

The date of the death of Queen Elizabeth is found in the first letters of these words: "*M*y *D*ay *C*los-ed *I*s *I*n *I*mmortality." In what year did she die?

The year of Queen Victoria's death is told in the initials of these words: "*M*any *C*ountries *M*ourn *I*ndeed." In what year did she die?

MORSE CODE NUMERALS

In addition to the Arabic figures and the Roman numerals, there is a third method of writing numbers. In what is called the Morse code, which is used in telegraphing, these are written in dots and dashes, in this way.

1. . — — .
2. . . — . .
3. . . . — .
4. . . . . —
5. — — —
6. . . . . . .
7. — — . .
8. — . . . .
9. — . . —
0. — — — — —

This is not presented here to be learned by the pupil, but to be examined, as a matter of information.

Three periods of numbers have been presented in Part I of this book. They are called, in order, Units, Thousands, and Millions. For stating the debts of great nations, the distances of the heavenly bodies, and some other enormous quantities, more than three periods must be used. The fourth period is called Billions. Thus the number 300,500,000,000 is read three hundred billions, five hundred millions.

1. Write sixty-five billions.

2. Write three billions, five hundred-thirty millions.

3. Write six billions, ten millions.

4. Read 3,875,462,100.

5. Read 5,000,000,000.

6. Read 10,250,000,000.

7. Read MCMXIII A. D.

8. Read MMMMIV B. C.

9. Psalm CXIX has 22 parts, and each part contains 8 verses. How many verses are there in all?

Read the following:

10. Pius VII, Gregory XVI, Pius IX, and Leo XIII were popes of the nineteenth century.

Louis XIV died in 1715.

Charles X was the last Bourbon king of France.

Charles XII of Sweden was called "The Madman of the North."

11. Mohammedans count their years from the Hegira, which occurred in A. D. DCXXII. What year was that?

12. The average distance of the earth from the sun is about 93,100,000 miles. If the distance were one hundred times as great, what would it be?

Perform mentally these progressive additions and subtractions as the teacher reads them slowly.

1. $3+4-2+7+8-9$.
2. $5+2-3-5+6+4$.
3. $4+6-3+7-2+5$.
4. $7+2-4+3+2-7$.
5. $6+3-2+5-7+4$.
6. $8+5-7+6+3-2$.
7. $1+6+4-3-5+6$.
8. $9+3-6+4+2-6$.
9. $4+7-3-2+9-6$.
10. $6+4+3+7+2+8+9+7$.

In the following progressive additions, the numbers which are to be counted as "five" or "ten" are placed in parenthesis, as a matter of convenience.

1. $(2+3)+(3+7)+(9+1)+(4+6)$.
2. $3+(6+4)+(5+5)+4+(3+7)$.
3. $2+(7+3)+3+(8+2)+7+1$.
4. $5+(3+2)+7+4+(5+5)+6$.
5. $7+6+3+(8+2)+9+(7+3)$.
6. $(8+2)+7+4+(6+4)+7+2$.
7. $5+1+3+(8+2)+5+(6+4)$.
8. $(4+1)+6+7+(9+1)+2+6$.
9. $(7+3)+2+6+3+(4+6)+8$.
10. $2+(4+6)+(5+5)+3+9+6$.

The parenthesis should be used in this way only in progressive additions—never in additions and subtractions together.

Perform mentally these progressive subtractions:

1. 18−3−2−4−5−1.
2. 20−5−2−3−6−3.
3. 23−4−3−1−2−5.
4. 50−9−8−4−7−6.
5. 48−2−5−3−7−6.
6. 29−4−3−1−2−4.
7. 36−7−5−4−2−5.
8. 52−3−7−5−4−2.
9. 45−2−6−5−3−1.
10. 65−10−9−4−1−3.
11. 86−5−3−7−20−8.
12. 100−20−30−25−15−5.

Perform mentally these progressive additions and subtractions:

1. 12+7−5+3−2+6.
2. 15−4−2+5+3−7.
3. 25−9+8−5+3+2.
4. 16−11+7+3+2−6.
5. 28+10+6+4+3+5.
6. 42−11+6−3+2+9.
7. 42−3+10−7−5+6.
8. 19+8+7+4−12−8.
9. 20−8+5+4−3−2.
10. 19−11+3+2+4+6.
11. 18+6−7−8+3+7−4.
12. 35−7−2+5+3+26.
13. 40−6−4+8+2+10−5.

FACTORING

$$3 \times 2 = 6$$

The number *six* is made by multiplying two and three together. The numbers which make a new number in this way are called *factors* of the new number. 2 and 3 are *factors* of 6.

The old word *factor* used to mean *maker;* and a place where things are made is called a *factory.*

$$6 \times 4 = 24$$

Here, six and four are factors of twenty-four; but six and four may both be divided into factors of their own. Where we use only factors such that none of them can be further divided exactly, (except by itself and 1) we are said to use prime factors.

> *A prime factor can be exactly divided only by itself and by one.*

$$2 \times 5 = 10$$

Is two a prime factor? Is five a prime factor?

Factors of numbers are found by dividing the numbers. All the numbers that can be divided into prime factors are called *composite* numbers. *Composite* means *put together.*

Is six a composite number? Is seven? Is nine? Is ten? Is eleven? Is twelve? Is thirteen?

All the *even* numbers can be exactly divided by *two.*

All other numbers are odd numbers.

Any number can be exactly divided by two if its figure in units' place is 0 *or* 2 *or* 4 *or* 6 *or* 8.

Of these numbers, tell at a glance which ones can be evenly divided by two:

1. 126
2. 278
3. 210
4. 94
5. 21
6. 237
7. 1976
8. 100
9. 213
10. 19
11. 1020
12. 124
13. 103
14. 175
15. 36
16. 71
17. 98
18. 270
19. 290
20. 48
21. 94
22. 92
23. 99
24. 83
25. 76

Any number can be exactly divided by five if its figure in units' place is 0 *or* 5.

Of these numbers, tell at a glance which ones can be evenly divided by five.

1. 1020
2. 735
3. 1954
4. 2417
5. 520
6. 312
7. 416
8. 7125
9. 8320
10. 2000
11. 75
12. 914
13. 250
14. 165
15. 320
16. 74
17. 96
18. 47
19. 90
20. 28
21. 19
22. 25
23. 310
24. 1095
25. 420

Any number can be exactly divided by three if the sum of its digits can be exactly divided by three.

54

What is the sum of the digits? Can nine be exactly divided by *three*? Can the number 54 be exactly divided by three?

Of these numbers, tell at a glance what ones can be exactly divided by three.

1. 63
2. 72
3. 123
4. 321
5. 627
6. 81
7. 27
8. 103
9. 42
10. 109
11. 54
12. 96
13. 129
14. 920
15. 921
16. 213
17. 310
18. 921
19. 183
20. 282
21. 96
22. 369
23. 72
24. 930
25. 192
26. 1492
27. 1776
28. 1215
29. 1914
30. 1616

$$\mathbf{672 = 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 7}$$

What are the prime factors of six hundred seventy-two? We see at a glance that six hundred seventy-two is divisible by two. Why?

Dividing the number continuously by two, we find that two can be used successively as a divisor of it how many times? After the last division by two, what is the quotient? Can twenty-one be divided by two? Why not? Can it be divided by three? Why? Can seven be divided by any number except itself and one?

2)672
2)336
2)168
2) 84
2) 42
3) 21
7) 7
1

Read all the divisors, or prime factors that you have used.

Find the prime factors of the following numbers:

1. 12
2. 15
3. 18
4. 24
5. 96
6. 108
7. 216
8. 130
9. 72
10. 21
11. 1004
12. 576
13. 289
14. 144
15. 1240
16. 832
17. 369
18. 1296
19. 298
20. 144
21. 576
22. 484
23. 3204
24. 1155
25. 396
26. 2016
27. 288
28. 1396
29. 240
30. 5511
31. 224
32. 435
33. 693
34. 423
35. 844
36. 534
37. 775
38. 525
39. 630
40. 1200

Find the products of these factors:

1. 2×2×3×3
2. 3×3×5×2
3. 2×5×5×7
4. 3×5×2×7
5. 2×3×5×3×3
6. 2×2×3×3×5
7. 5×7×5×7
8. 7×7×7×7
9. 2×2×2×2× 2×2
10. 3×3×3×3× 3×3
11. 2×3×2×3× 2×3
12. 7×7×2×5× 7×7
13. 5×7×5×7× 5×2
14. 2×5×3×7×13
15. 17×3×3×2× 5
16. 19×3×7×5× 2

The work in these problems need not be all written to secure the result. The ingenuity of the pupil should be exercised in saving time and work by saying "four" instead of 2×2, by saying "ten" instead of 2×5, etc. In every case the pupil should state *how* he reached his result, so that his steps may be compared with those of others doing the same work. Thus in problem 14, the pupil may say "ten", "twenty-one" and "thirteen;" and his written work will be only the multiplication of 210 by 13. A full statement of the result should be required Thus: "the product of 2, 5, 7, 3, and 13 is 2730."

PARTS OF A DOLLAR

A part of a unit is called a *fraction* of it. When a unit is divided into two parts, what is each called? When it is divided into three parts? When it is divided into four parts? When it is divided into five parts?

A complete number is called an *integer*.

In ancient days, a soldier who was not wounded was called an integer. In our own time, an individual whose moral character has not been impaired is called a person of *integrity;* and when we speak of the integrity of a fund of money, we mean its preservation from any division or loss.

Whole numbers are often called *integers*, to distinguish them from fractions.

A number which is part integral and part fractional is called a *mixed number;* as $2\frac{1}{2}$, $16\frac{2}{3}$, $33\frac{1}{3}$.

The old word *fraction* once meant a *breaking*; and many people even now speak of "breaking" a dollar, or "breaking," a bill, when they mean *changing* it into smaller pieces of money.

Here are some fractions of a dollar that are so constantly used in making change or in keeping accounts that they should be perfectly familiar, and ready in the mind for instant use at all times:

Write, and read in turn:

1. $\frac{1}{2}$ of a dollar is 50 cents.
2. $\frac{1}{3}$ of a dollar is $33\frac{1}{3}$ cents.
3. $\frac{2}{3}$ of a dollar is $66\frac{2}{3}$ cents.
4. $\frac{1}{4}$ of a dollar is 25 cents.
5. $\frac{1}{6}$ of a dollar is $16\frac{2}{3}$ cents.

6. $\frac{1}{5}$ of a dollar is 20 cents.

7. $\frac{1}{8}$ of a dollar is $12\frac{1}{2}$ cents.

8. $\frac{1}{10}$ of a dollar is 10 cents, or one dime.

9. $\frac{1}{12}$ of a dollar is $8\frac{1}{3}$ cents.

10. $\frac{1}{16}$ of a dollar is $6\frac{1}{4}$ cents.

11. $\frac{1}{25}$ of a dollar is 4 cents. $\frac{1}{20}$ of a dollar is 5 cents, or one nickel.

12. $\frac{1}{100}$ of a dollar is 1 cent.

Recite from memory.

13. If I pay a dollar for three boxes of stationery, what does each box cost?

14. If six collars cost a dollar, what is the price of each?

15. If three photographs cost a dollar, what do two of them cost?

16. If a dozen cantaloupes cost a dollar, what does each one cost?

17. If a merchant buys handkerchiefs at the rate of twelve for one dollar, and sells them at the rate of eight for one dollar, what is the cost price of each? What is the selling price?

18. If a grocer buys eggs at the rate of five dozen for a dollar, and sells them at the rate of four dozen for a dollar, what is his profit on each dozen?

19. If a dealer buys a set of six plates for a dollar, and sells them for one dollar twenty cents, what is the cost price of each plate? —the selling price?

20. If you buy sixteen apples for a dollar, what do you pay for each?

21. If a hatter gains a dollar on the sale of six caps, what does he gain on each?

22. If a family saves a dollar on gas every twelve days, how much does it save each day?

23. If a sixteen-ride car ticket costs a dollar, what does each ride cost?

24. If six pounds of meat cost a dollar, what is the cost of each pound?

25. If one and one-half dozen buttons cost a dollar, what does each button cost?

26. If six pounds of steak cost a dollar, what does one pound cost?

27. When cotton costs sixteen and two-thirds cents a pound, how many pounds would a dollar buy?

28. If six and one-fourth pounds of bacon cost one dollar, what does the bacon cost the* pound?

29. If sixteen pounds of sugar cost one dollar, what does the sugar cost the pound?

30. If twelve yards of cloth cost one dollar, what does the cloth cost the yard?

31. If you buy braces at six pairs the dollar, and sell them at eight pairs the dollar, what is the buying price and what the selling price the pair?

---

*"The pound," "a pound," and "per pound" are varied expressions for the same idea. "The pound" is the form that is dominant in the language of trade of the English-speaking world abroad, and it is now favored by careful speakers and writers of this country as well. All three of the forms of expression are used in this book, to insure familiarity with them.

Perform the following additions:

1.	2.	3.
$132.65	$516.93	$7,560.45
49.32	373.22	711.55
423.58	37.19	3,161.37
191.45	118.61	1,298.40
382.73	925.86	5,117.30
77.42	315.24	2,438.63

Perform the following subtractions:

1.	$132.65	4.	$516.93	7.	$1,560.45
	49.32		373.22		711.55
2.	$423.58	5.	$ 37.19	8.	$3,161.37
	91.45		8.61		1,298.40
3.	$382.73	6.	$925.86	9.	$5,117.30
	77.42		315.24		2,438.63

Multiply the following amounts successively by 8, by 12, and by 43:

1.	$132.65	4.	$516.93	7.	$1,560.45
2.	49.32	5.	373.22	8.	711.55
3.	423.58	6.	37.19	9.	3,161.37

Divide the following amounts successively by 8, by 12, and by 43:

1.	$191.45	3.	$118.61	5.	$1,298.40
2.	382.73	4.	925.86	6.	5,117.30

Note—In the above and in all subsequent additions, the pupils should be encouraged to combine mentally two or more figures as one number, where it may be easily done, as in the first column of the first example: (2 and 3) 5+5=10. 10+(8 and 2) 10=20. 20+5=25. Pupils should not *think* the words "plus," "are," or "equals" but simply pronounce mentally the successive values as 5, 10, 20, 25. *Addition in arithmetic is adding without counting.*

If you should purchase the following articles and should hand the storekeeper $1.00 in payment each time, what amount of change would you receive? Make the solutions mentally when you can.

1. Fourth Reader, 40 cents.
2. 3 dozen oranges, at 30 cents the dozen.
3. Fish hook, rod and line, 65 cents.
4. Pair of skates, 95 cents.
5. Pocket knife, 85 cents.
6. 2½ pounds of candy, at 30 cents the pound.
7. 3 pounds of butter, at 28 cents the pound.

Paying for each of the following purchases with a two-dollar bill, you will receive what amount in change?

1. 3 dozen bananas, at 35 cents the dozen.
2. 6 yards of ribbon, at 27 cents the yard.
3. 10 pounds of sugar, at 6½ cents the pound.
4. 2½ dozen lemons, at 30 cents the dozen.
5. 3 pounds of cheese, at 18 cents the pound.
6. 2 napkin rings, at 95 cents each.
7. 4 pounds of coffee, at 35 cents the pound.

Paying for each of the following purchases with a five-dollar bill, you will receive what amount in change?

1. Student lamp, $3.60.
2. Rocking chair, $4.25.
3. Picture frame, $3.45.
4. Lawn mower, $4.35.
5. Book rack, $2.96.

If you should sell the following articles and receive in payment two one-dollar bills in each case, what amount of change should you give to the purchaser? Who bears the greater responsibility for correctness in making change—the buyer or the seller?

1. 1 gallon of maple syrup at $1.20.
2. 1½ bushels of seed corn at 84 cents per bushel.
3. ½ dozen watermelons at 32 cents each.
4. 1 barrel of apples, $1.62.
5. 3 bushels of pears at 55 cents per bushel.
6. 4 bushels of potatoes at 37½ cents per bushel.

Or if you were a salesman in a general store, what change would you have to give to the purchaser of the following articles, if the amount of money handed to you in each case should be three dollars?

1. ½ dozen tablespoons, at $5.00 the dozen.
2. 2 yards of silk, at $1.25 the yard.
3. 1 flower vase, $2.60.
4. 2 candlesticks, at $1.20 each.
5. ½ dozen plated knives, at $5.50 the dozen.
6. 16 yards of calico at 15 cents the yard.

On the following purchases, what change would be required if the payment in each case should be made with a five-dollar bill?

1. 2½ kegs ten penny nails at $1.80 the keg.
2. 1 metal water cooler, $4.10.
3. ½ doz. Victrola records, at 75 cents each.
4. 1 ten-inch globe, $3.50.
5. 1 United States flag, $4.90.

Find the sums of the following numbers in the easiest way.

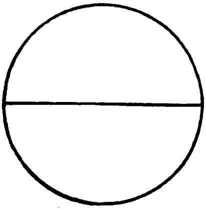
1.	4 44 444 4444 44444	2.	5 55 555 5555 55555	3.	6 66 666 6666 66666
4.	7 77 777 7777 77777	5.	8 88 888 8888 88888	6.	9 99 999 9999 99999
7.	1234 4321	8.	12345 54321	9.	123456 654321
10.	1234567 7654321	11.	12345678 87654321	12.	123456789 987654321

Perform the subtractions indicated:

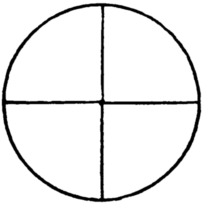
1. 47 − 32
2. 371 − 219
3. 8642 − 7146
4. 32964 − 22436
5. 716391 − 597634
6. 5496812 − 3796124
7. 23769851 − 17469587
8. 83 − 65
9. 496 − 379
10. 5427 − 4685
11. 72150 − 62564
12. 649713 − 572135
13. 7396205 − 6389456
14. 83285972 − 79863299

Multiply and divide each of the following numbers by 4, by 14, and by 41:

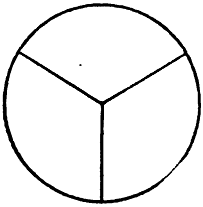
1.	2.	3.	4.	5.
474	592	5,614	21,667	329,684



HALVES



FOURTHS



THIRDS

1. How many halves are there in a cheese? —in three cheeses?

2. How many quarters are there in a cheese? —in two cheeses?

3. How much is left of two cheeses when you take away one-half of one of them?

4. How much is left of a cheese when you take away one-fourth of it?

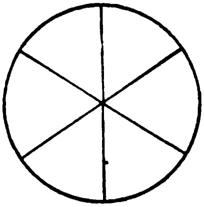
5. In one-third of a cheese there are how many sixths of the cheese?

6. How much of a cheese is left when you take away one-sixth of it? —two-sixths of it? —five-sixths of it?

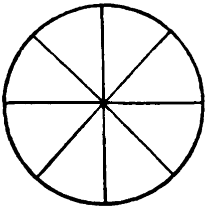
7. If you buy one-third of a cheese, and use one-sixth of the whole cheese, how much have you left?

8. One-half of a cheese is how many twelfths of it?

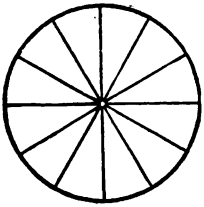
NOTE—The simple exercises in fractions here given are not presented in a formal manner. Technical terms are avoided. The pupil is to find, by observing the drawings and comparing the parts delineated, the relations which these parts sustain to the whole and to one another. This is an observational study and an application of processes previously learned, rather than a study of new processes. A technical presentation of fractions is reserved for the succeeding textbook in this series.



SIXTHS



EIGHTS



TWELFTHS

9. One-third of a cheese is how many twelfths of it?

10. One-fourth of a cheese is how many twelfths of it?

11. One-sixth of a cheese is how many twelfths of it?

12. One-third of a cheese and one-fourth of a cheese are how many twelfths of it?

13. One-third of a cheese and one-sixth of a cheese are how many twelfths of it? In what other way can you state this fraction?

14. One-fourth of a cheese and one-sixth of a cheese are how many twelfths of it?

15. One-fourth of a cheese and one-twelfth of a cheese are how many twelfths of it? In what other way can you state this fraction?

16. Five-twelfths of a cheese less one-twelfth of a cheese are how many twelfths of it? In what other way can you state this fraction?

17. Seven-twelfths of a cheese and one-sixth of a cheese are how many twelfths of it? In what other way can you state this fraction?

18. Five-twelfths of a cheese and one-fourth of a cheese are how many twelfths of it? In what other way can you state this fraction?

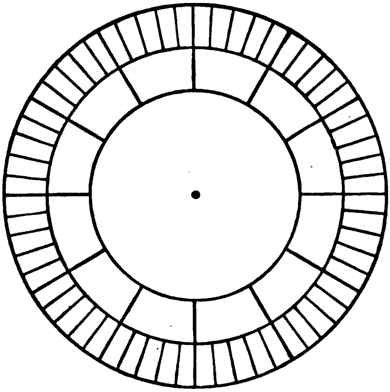
19. Ten-twelfths of a cheese less one-twelfth of a cheese are how many twelfths of it? In what other way can you state this fraction?

20. Three-fourths of a cheese less one-fourth of a cheese are how many twelfths of it? How else can you state this fraction?

21. Two-thirds of a cheese is how many twelfths of it?

22. How many eighths of a cheese are there in four cheeses?

A STUDY OF THE CLOCK FACE



1. Here is an unfinished clock face. The divisions of the inner circle are for the hour hand to pass over. How many are there of these?

Each of these divisions is what part of the whole inner circle?

2. The divisions of the outer circle are for the minute hand to pass over. How many are there of these? Each of these divisions is what part of the whole outer circle?

3. How many sixtieths of the circle are there in one-twelfth of it? Count them.

4. How many sixtieths of the circle are there in two-twelfths, or one-sixth of it? Count them.

5. How many sixtieths of the circle are there in three-twelfths, or one-fourth of it? Count them.

6. How many sixtieths of the circle are there in four-twelfths, or one-third of it. Count them.

7. How many sixtieths of the circle are there in six-twelfths or one-half of it? Count them.

8. One-third of the circle, is how many sixtieths of it? In what other ways can you state this fraction?

9. One-third of the circle, less one-twelfth of the circle, is how many sixtieths of it? In what other ways can you state this fraction?

10. One-third of the circle, less one-sixth of the circle is how many sixtieths of it? In what other ways can you state this fraction?

11. One-twelfth of the circle and one-third of the circle are how many sixtieths of it? In what other way can you state this fraction?

12. One-fourth of the circle and one-third of the circle are how many sixtieths of it? —how many twelfths of it? —how many fourths?

13. Two-twelfths of the circle are how many sixtieths of it? Count them.

14. Three-twelfths of the circle are how many sixtieths of it? Four-twelfths of the circle are how many sixtieths of it? Count them.

15. Six-twelfths of the circle are how many sixtieths of it? —how many thirds of it? —how many fourths of it?

16. Six-twelfths of the circle, less one-third of the circle, is how many sixtieths of it?

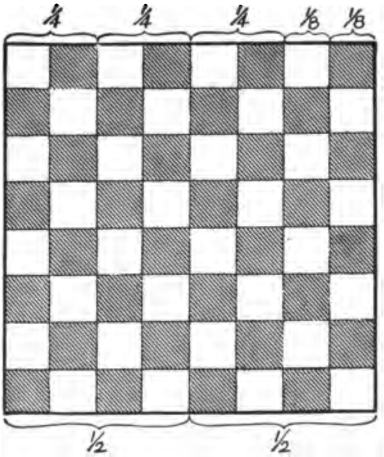
17. Six-twelfths of the circle, less one-fourth of the circle is how many sixtieths of it?

18. One-third of the circle and one-fourth of the circle are how many sixtieths of it? Count them.

19. One-fourth of the circle and one-sixth of the circle are how many sixtieths of it? Count them.

20. One-half of the circle and one-twelfth of the circle are how many sixtieths of it? Count them.

A STUDY OF THE CHECKER BOARD.



1. The checker board has eight rows of squares, eight in each row. One-half of the board has how many rows? —how many squares?

2. One-quarter* of the board has how many rows? —how many squares?

3. One-eighth of the board has how many rows? —how many squares?

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*The board is divided into quarters which are not square, but are made up of perpendicular rows. See brackets at the top showing division into quarters and eighths. The teacher is cautioned against haste in passing through this work.

4. How many squares does one row contain? What part of the row is one square? What part of the row is two squares? —four squares?

5. In one-half of the board there are how many eights of it?

6. In one-quarter of the board there are how many eights of it?

7. In three-quarters of the board there are how many eighths of it?

8. *One-sixteenth of the board is one-half of one row.* How many squares of the board are there in one-sixteenth of it? Count them.

9. One-fourth of the board is how many rows? —how many squares? Count them.

10. Three-fourths of the board are how many rows? —how many squares? Count them.

11. Three-eighths of the board are how many rows? —how many squares? Count them.

12. Six-eighths of the board are how many rows? —how many squares of it? Count them.

13. Eight-sixteenths of the board are how many eighths of it? —how many quarters of it?

14. Twelve-sixteenths of the board are how many eighths of it? —how many quarters of it?

15. In one-half of the board there are how many squares? What part of the board will four squares be? In four-sixteenths there are how many eighths?

1. Twelve things make one dozen. How many dozen are there in forty-two things?

2. If a laundry charges ten cents apiece for laundering shirts, and two cents apiece for laundering collars, what will be its charge for laundering eight shirts and ten collars?

3. If a laundry charges fifty cents the dozen for rough dry work, what will it charge for sixty-six pieces?

4. If oranges cost forty cents the dozen, what will be the cost of one apiece for a company of thirty persons?

5. What is the difference between six dozen dozen and half a dozen dozen?

6. How many months are there in a dozen years? In three dozen years?

7. Twelve dozen make a gross. How many gross are there in fourteen hundred forty? In seven hundred twenty? In two hundred sixteen?

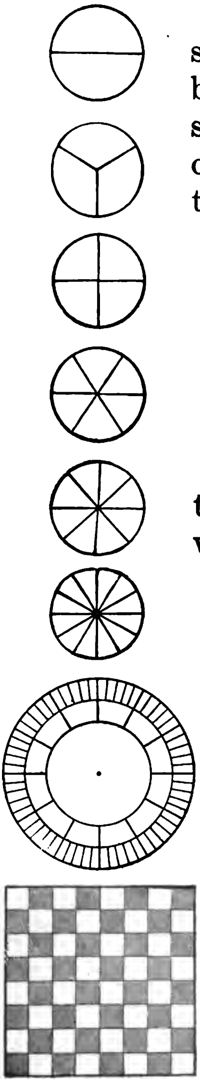
8. Twenty things make a score. If a man lives to be three score and ten years of age, how old is he then?

9. Three score are how many dozen?

10. A gross is how many score?

11. If a boat becomes unfastened at the pier, and drifts down the river at the rate of seven miles an hour, how far down will it be in thirty-six hours?

12. Twelve gross make one great-gross. In a great-gross there are how many dozen?



The following problems are to be solved as the previous ones have been, by comparisons of fractional parts as set forth graphically in the illustrations, on the margin, which are to be referred to constantly.

Add $\frac{1}{3}$ and $\frac{3}{4}$.

Here is the statement of the work:

$$\frac{1}{3}=\frac{4}{12}.$$
$$\frac{3}{4}=\frac{9}{12}$$
$$\frac{4}{12}+\frac{9}{12}=\frac{13}{12}, \text{ or } 1\frac{1}{12}.$$

Perform these additions and subtractions, and write statements of the work:

1. $\frac{1}{3}+\frac{1}{4}$
2. $\frac{1}{2}+\frac{3}{4}$
3. $\frac{5}{6}-\frac{1}{12}$
4. $\frac{11}{12}+\frac{1}{12}$
5. $\frac{1}{2}+\frac{2}{3}$
6. $\frac{3}{4}-\frac{1}{3}$
7. $\frac{3}{4}-\frac{2}{3}$
8. $\frac{1}{6}+\frac{3}{6}$
9. $\frac{1}{3}+\frac{2}{3}$
10. $\frac{1}{2}+\frac{3}{4}$
11. $\frac{7}{12}-\frac{5}{12}$
12. $\frac{1}{8}+\frac{1}{4}$
13. $\frac{1}{8}+\frac{3}{4}$
14. $\frac{5}{8}-\frac{1}{4}$
15. $\frac{1}{8}+\frac{3}{8}$
16. $\frac{7}{8}-\frac{1}{4}$
17. $1\frac{1}{2}+\frac{3}{4}$
18. $2\frac{1}{3}-\frac{2}{3}$
19. $\frac{3}{4}+1\frac{1}{4}$
20. $\frac{5}{6}+1\frac{1}{6}$

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21. $\frac{15}{64}-\frac{7}{64}$
22. $\frac{13}{32}+\frac{5}{32}$

$$\tfrac{1}{3} \text{ of } \mathbf{12 = 4} \qquad \qquad \tfrac{1}{3} \times \mathbf{12 = 4}$$

Here are two ways of showing that one-third and 12 are used as factors of a number. Where fractions are used in multiplication, either form of statement can be used, since both of the expressions *mean the same thing.* Write statements of these multiplications, using the sign ×:

1. $\frac{1}{3} \times 12$ is what number?
2. $12 \times \frac{1}{2}$ is what number?
3. $\frac{2}{3} \times 12$ is what number?
4. $\frac{1}{4} \times 12$ is what number?
5. What number is $\frac{1}{6}$ of 12?
7. $\frac{3}{4} \times 12$ is what number?
8. $12 \times \frac{1}{6}$ is what number?
9. $\frac{3}{8} \times 4$ is what number?
10. $\frac{2}{3} \times 2$ is what number?
11. $\frac{1}{2} \times 3$ is what number?
12. $\frac{1}{6} \times 7$ is what number?
13. What is $\frac{1}{2}$ of $\frac{2}{3}$? (Change one of the fractions to twelfths.)
14. What is $\frac{1}{3}$ of $\frac{3}{4}$?
15. What is $\frac{3}{4} \times \frac{1}{3}$?
16. $\frac{1}{8} \times \frac{18}{19}$ is what number?
17. $\frac{2}{3} \times 12$ is what number?
18. Two thirds of twelve-fifteenths is what number?
19. $\frac{1}{7} \times \frac{21}{30}$ is what number?
20. Four-fifths of twenty-sixtieths is what number?

1. If I bought half a dozen buttons, and then a quarter of a dozen of the same, what part of a dozen did I buy in all? How many buttons were bought?

2. A merchant sold one-third of a sack of coffee, and then one-fourth of it. What part of it did he sell in all?

3. A family ate at dinner three-fourths of a blackberry pie, and two-thirds of a huckleberry pie. How much pie was eaten?

4. Mary made two-thirds of a yard of crochet work, and her sister Louise made one and two-thirds yards of it. How many yards of it did they make in all?

5. Henry managed one-half of a garden patch, and his brother Charles managed one-third of it. What part of the garden patch did they manage in all?

6. If five-sixths of a farm is planted with grain, and the rest of it is used for pasture, what part of it is used for pasture?

7. If I buy five-eighths of a yard of velvet, and use only three-eighths of a yard, what part of a yard do I have left?

8. John raised three and one-fourth bushels of beans, and Fred raised two and one-third bushels. How many bushels of beans were raised in all?

9. Robert earned $\frac{3}{4}$ of a dollar each day for four days. How many dollars did he earn?

10. Joe owned $\frac{3}{4}$ of a flock of sheep, and sold one-third of what he owned. What part of the flock did he sell?

11. Frances had one-third of a dozen souvenir spoons, and lost one-fourth of them. What part of a dozen did she lose?

12. Ella passed one-fourth of a year in Chicago each year for 6 years. How many years' time in all did she pass in that city?

13. Harvey paid one-sixth of a dollar apiece for 9 lunches at a restaurant. How many dollars did he pay for them?

14. William worked one-third of each day for twelve days. How many days' time did he work in all?

15. A railway train lost one-sixth of its schedule time on each of four trips. What part of its schedule time for a trip did it lose in all?

16. A woman buys 2 barrels of flour, and uses two-thirds of the whole amount. What part of the second barrel does she use?

17. A man gains a quarter of an hour each day for for nine days, by rising earlier, and then loses a third of an hour each day for two days oversleeping. How much time does he gain in the eleven days?

18. If half the black squares of half a checker-board are occupied by checkers, how many sixty-fourths of the whole board are occupied?

Divide $\frac{1}{2}$ by **3**.

Here is a statement of the work:

$$\frac{1}{2}=\frac{3}{6}$$
$$\frac{3}{6}\div 3=\frac{1}{6}$$

Perform these divisions, and write statements of the work:

1. $\frac{1}{4}\div 3$
2. $\frac{1}{2}\div 4$
3. $\frac{2}{3}\div 4$
4. $\frac{1}{2}\div 6$
5. $\frac{1}{4}\div 2$
6. $\frac{1}{6}\div 2$
7. $\frac{3}{12}\div 3$
8. $1\frac{1}{2}\div 3$
9. $2\frac{2}{3}\div 4$
10. $1\frac{1}{3}\div 2$
11. $1\frac{1}{3}\div 4$
12. $2\frac{1}{2}\div 5$
13. $6\frac{2}{3}\div 4$
14. $7\frac{1}{2}\div 5$

Divide **2** by $\frac{2}{3}$

Here is a statement of the work:

$$2=\frac{6}{3}$$
$$\frac{6}{3}\div\frac{2}{3}=3$$

It is plain that in 6 thirds there are 3×2 thirds, and that two-thirds may be taken from 6 thirds successively 3 times.

Perform these divisions, and write statements of the work:

1. $3\div\frac{1}{2}$
2. $4\div\frac{1}{2}$
3. $3\div\frac{1}{3}$
4. $1\div\frac{1}{12}$
5. $1\div\frac{1}{6}$
6. $2\div\frac{1}{3}$
7. $4\div\frac{1}{3}$
8. $4\div\frac{1}{4}$
9. $6\div\frac{1}{2}$
10. $6\div\frac{1}{3}$
11. $6\div\frac{1}{4}$
12. $6\div\frac{1}{6}$
13. $8\div\frac{1}{2}$
14. $8\div\frac{1}{4}$
15. $12\div\frac{1}{2}$
16. $12\div\frac{1}{3}$

17. John has 2 dollars. With it he can buy how many books at one-third of a dollar apiece? —at one quarter of a dollar apiece?

18. Three gallons of milk will fill how many milk jars that hold $\frac{1}{2}$ of a gallon each?

19. If a train goes two-thirds of a mile a minute, how far will it go in 6 minutes?

20. A common brick is two-thirds of a foot long. How many such bricks, placed end to end, will reach 6 feet?

21. $1\frac{1}{2}$ yards make a French ell. How many French ells are there in 3 yards?

22. A foot is one-third of a yard. How many feet are there in 4 yards?

23. In old times a room was called a "quarter" because it was $\frac{1}{4}$ of a house. How many houses were required for 12 such "quarters?"

24. If school is in session $\frac{3}{4}$ of each year, in how many years will its session equal four full years?

25. In former ages a regiment of soldiers was punished for mutiny by executing $\frac{1}{10}$ of the men, chosen by lot. This was called *decimating* a regiment. If a regiment of a thousand men was decimated twice, how many men would there be left?

26. Two men buy a house for $3000, one paying $1200, and the other $1800. They agree to admit a third man into the purchase, all sharing equally. How much will the third man pay to each of the others?

Test the pupils' progress by oral solutions of the simplest of the following problems:

Add:

1. $2\frac{1}{2}$ $3\frac{1}{2}$	2. $3\frac{1}{4}$ $4\frac{3}{4}$	3. $5\frac{1}{3}$ $6\frac{2}{3}$	4. $7\frac{1}{2}$ $8\frac{1}{2}$	5. $9\frac{3}{4}$ $7\frac{1}{4}$
6. $8\frac{1}{3}$ $9\frac{2}{3}$	7. $10\frac{1}{2}$ $5\frac{1}{2}$	8. $4\frac{1}{8}$ $5\frac{7}{8}$	9. $6\frac{1}{2}$ $8\frac{1}{4}$	10. $8\frac{5}{8}$ $3\frac{3}{8}$
11. $7\frac{2}{3}$ $5\frac{2}{3}$	12. $8\frac{3}{4}$ $6\frac{3}{4}$	13. $9\frac{3}{8}$ $7\frac{5}{8}$	14. $6\frac{1}{6}$ $8\frac{3}{6}$	15. $7\frac{1}{4}$ $5\frac{1}{2}$
16. $6\frac{1}{9}$ $7\frac{8}{9}$	17. $14\frac{5}{6}$ $2\frac{2}{3}$	18. $16\frac{3}{8}$ $3\frac{5}{8}$	19. $18\frac{3}{4}$ $4\frac{1}{2}$	20. $20\frac{2}{3}$ $4\frac{1}{6}$

Subtract:

1. $6\frac{3}{4}$ $4\frac{1}{4}$	2. $7\frac{1}{2}$ $5\frac{1}{4}$	3. $3\frac{3}{8}$ $2\frac{1}{4}$	4. $5\frac{1}{4}$ $3\frac{1}{8}$	5. $7\frac{1}{2}$ $5\frac{1}{2}$
6. $12\frac{1}{2}$ $8\frac{1}{4}$	7. $15\frac{7}{8}$ $5\frac{1}{2}$	8. $14\frac{5}{6}$ $7\frac{2}{3}$	9. $16\frac{2}{3}$ $6\frac{1}{6}$	10. $18\frac{3}{4}$ $8\frac{1}{2}$
11. $8\frac{3}{4}$ $6\frac{1}{4}$	12. $9\frac{1}{2}$ $5\frac{1}{2}$	13. $10\frac{2}{3}$ $4\frac{1}{3}$	14. $12\frac{2}{3}$ $7\frac{1}{6}$	15. $16\frac{3}{4}$ $10\frac{1}{2}$
16. $10\frac{2}{3}$ $6\frac{1}{6}$	17. $11\frac{3}{4}$ $10\frac{1}{2}$	18. $8\frac{5}{8}$ $6\frac{1}{2}$	19. $9\frac{3}{4}$ $5\frac{1}{2}$	20. $10\frac{3}{4}$ $8\frac{3}{8}$
21. $9\frac{5}{8}$ $5\frac{1}{2}$	22. $12\frac{5}{8}$ $9\frac{1}{4}$	23. $14\frac{2}{3}$ $6\frac{1}{6}$	24. $18\frac{1}{3}$ $7\frac{1}{6}$	25. $20\frac{5}{6}$ $12\frac{1}{3}$

Add (by comparing parts shown on pages 141-2):

1.	**2.**	**3.**	**4.**	**5.**
$247\frac{1}{2}$	324	$490\frac{3}{8}$	$620\frac{1}{6}$	$596\frac{1}{8}$
122	$671\frac{3}{4}$	$87\frac{1}{2}$	215	210
$39\frac{1}{6}$	$93\frac{1}{4}$	115	$528\frac{1}{2}$	$132\frac{1}{2}$
$480\frac{1}{3}$	215	219	49	$409\frac{3}{8}$
213	$450\frac{1}{2}$	$627\frac{1}{8}$	$268\frac{1}{3}$	87

6.	**7.**	**8.**	**9.**	**10.**
$876\frac{1}{2}$	711	816	$972\frac{1}{3}$	$311\frac{3}{8}$
$439\frac{1}{3}$	$43\frac{3}{4}$	$205\frac{1}{8}$	$425\frac{1}{6}$	$219\frac{1}{8}$
217	$111\frac{1}{8}$	$211\frac{1}{4}$	714	784
$131\frac{1}{6}$	516	$119\frac{1}{4}$	$523\frac{1}{2}$	$926\frac{1}{2}$

Subtract (by comparing parts shown on pages 141-2):

1.	**2.**	**3.**	**4.**	**5.**
$324\frac{3}{4}$	$906\frac{1}{2}$	634	$907\frac{7}{8}$	$368\frac{5}{6}$
$121\frac{1}{4}$	$412\frac{1}{4}$	$43\frac{2}{3}$	$218\frac{1}{2}$	$207\frac{1}{3}$

6.	**7.**	**8.**	**9.**	**10.**
$483\frac{1}{3}$	$621\frac{3}{8}$	$840\frac{5}{7}$	$531\frac{2}{3}$	$478\frac{3}{8}$
211	$116\frac{1}{4}$	163	$100\frac{1}{6}$	297

11.	**12.**	**13.**	**14.**	**15.**
$972\frac{5}{6}$	$516\frac{7}{8}$	$211\frac{5}{8}$	$406\frac{3}{4}$	$626\frac{1}{2}$
$781\frac{2}{3}$	$39\frac{3}{4}$	$91\frac{1}{4}$	$245\frac{1}{8}$	$75\frac{3}{8}$

16.	**17.**	**18.**	**19.**	**20.**
$862\frac{1}{8}$	$496\frac{1}{9}$	$356\frac{1}{3}$	$462\frac{1}{2}$	$671\frac{1}{12}$
641	121	$120\frac{1}{6}$	$207\frac{3}{8}$	$419\frac{1}{6}$

21.	**22.**	**23.**	**24.**	**25.**
$392\frac{3}{5}$	$546\frac{1}{2}$	$487\frac{7}{12}$	$632\frac{1}{2}$	$728\frac{5}{9}$
$240\frac{2}{5}$	$324\frac{3}{8}$	$321\frac{1}{6}$	$501\frac{1}{4}$	$486\frac{2}{9}$

Multiply (as in problems on page 117):

1. 108 by $12\frac{1}{4}$
2. 312 by $10\frac{1}{3}$
3. 560 by $14\frac{1}{5}$
4. 732 by $15\frac{1}{6}$
5. 640 by $18\frac{1}{5}$
6. 822 by $16\frac{1}{3}$

7. 464 by $20\frac{1}{8}$
8. 196 by $22\frac{1}{4}$
9. 917 by $25\frac{1}{7}$
0. 396 by $28\frac{1}{9}$
11. 750 by $29\frac{3}{5}$
12. 846 by $31\frac{5}{6}$

13. 4960 by $135\frac{1}{5}$
14. 1236 by $231\frac{1}{6}$
15. 5894 by $460\frac{1}{7}$
16. 3964 by $521\frac{1}{4}$
17. 2871 by $378\frac{1}{3}$
18. 7317 by $405\frac{1}{9}$

19. 6575 by $381\frac{1}{5}$
20. 8248 by $439\frac{1}{8}$
21. 1323 by $568\frac{1}{3}$
22. 5184 by $319\frac{1}{9}$
23. 7216 by $614\frac{1}{4}$
24. 9280 by $738\frac{1}{5}$

Divide (as in the work on page 114):

1. 4389 by 28
2. 9152 by 29
3. 3139 by 14
4. 7072 by 31
5. 8341 by 51
6. 8778 by 36

7. 6634 by 24
8. 8928 by 28
9. 8281 by 54
10. 7257 by 32
11. 7659 by 15
12. 8996 by 46

13. 15170 by 61
14. 10712 by 41
15. 10553 by 54
16. 14828 by 72
17. 21736 by 83
18. 25232 by 91

19. 22454 by 76
20. 37476 by 86
21. 29082 by 99
22. 31501 by 98
23. 38430 by 73
24. 48118 by 78

DENOMINATE NUMBERS

In all our work thus far, we have had to do with numbers in their orders. If any of these numbers were moved one place to the left it would mean ten times as much as it means where it is. We have studied the reading and writing of such numbers. We have studied the addition, subtraction, multiplication, and division of such numbers. We have become familiar with them.

But arithmetic includes a great deal more than this. We have now to deal with **denominations.** These are measures of different kinds, such as inches, feet, and yards; pints, quarts, and gallons; ounces, pounds, and hundredweights; etc., etc.

We shall find that these denominations do **not** increase in value from right to left in the same way. We cannot say that ten inches make one foot, and ten feet make one yard; or that ten pints make one quart and ten quarts make one gallon. It would not be true. Every table of denominations must be learned separately; and we shall find an interesting variety in comparing the different measures used.

Units of measure are called **denominations;** *and that part of arithmetic which relates to them is called* **denominate numbers.**

In this book only a very brief introduction to denominate numbers can be given. A more comprehensive treatment of the subject will be given in the next book of this series.

Things that can be carried in baskets or marketed in crates are generally measured in quarts, pecks, and bushels. Potatoes, apples, Indian corn, wheat, oats, barley, berries, etc., are measured in this way. The quart measure is generally a circular wooden box, and is not exactly the same in size as the quart measure used for milk and other liquids. The peck measure is a larger box, though baskets and buckets are sometimes made to hold exactly a peck. Bushel measures are generally baskets. Half-bushel measures may be either circular boxes, or baskets. In measuring potatoes, apples, corn, etc., the measure must be heaped.

Mention some things that are sold or carried in baskets or in boxes. Mention some things that are sold in glass jars or bottles, or in tin cans.

Did you ever see anything poured into a tin quart measure? If so, what was it? Did you ever see anything measured in a wooden quart measure? If so, what was it?

1. John and Harry picked twenty quarts of blackberries, and sold them for twelve cents the quart. What did they each receive for the fruit, both boys sharing equally?

2. A grocer bought fifty bushels of potatoes, and sold them all; but because of the inexact way of measuring them, they amounted to only forty-eight and one-half bushels when he sold them. How much of the quantity did he lose through the imperfect

way of measuring them? If he had bought and sold them by weight, would he have had any loss of this kind?

3. If the merchant's profit was to be 20 cents the bushel, what would it have been on the whole quantity had the measurements been correct? Besides losing what he had paid for the missing amount, what profit did he lose on it?

4. In measuring milk and other liquids, does it make any difference in the amount whether the top of the measure be large or small? If not, why not?

5. In measuring berries, apples, or potatoes that have to be heaped,* does it make any difference whether the top of the measure be large or small? If so, why?

6. In pouring liquids from a measure is it convenient to have the top of the measure smaller than the bottom?

7. Is this matter of convenience equally important in measuring fruits, grains, vegetables, etc.?

8. How do the sides of the measures for liquids usually slant? How do the sides of the measures for fruits, vegetables, grains, etc., usually differ from these?

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*The "heaping" is to make up for the unfilled spaces between the berries, etc., in the measure. The pupil should have a true idea of what is meant by "heap." Many people use the word simply to express quantity, as when they say "There is a *heap* of water in the river." Did any one ever really see a heap of water?

9. If the bushel measures are not heaped in exactly the same way when potatoes are put in a cellar for storage and when they are taken from the cellar for sale, the same potatoes will not measure the same amount both times. Where products measure the same amount when they are bought and when they are sold, we say that they "*hold out.*"

If in selling 100 bushels of apples a clerk so heaped the measure that the quantity lacked a bushel of holding out, what part of a bushel was lost with each of the 99 bushels sold?

10. A grocer buys 100 bushels of apples, and sells them by the peck. There are four pecks in the bushel. How may pecks does he sell? If his profit is forty cents on each bushel, how much is it on each peck?

11. If a garden truck man buys one hundred pumpkins at six cents each, and sells them at eighteen cents each, what is the amount of his profit?

12. Frank and Henry filled a peck measure sixteen times in picking cranberries. There are eight quarts in the peck. How many quarts did they pick?

13. Of forty sacks of potatoes, each holding one and one-half bushels, seven were exposed to frost and spoiled. How many bushels were saved?

14. There are two pints in the quart. Thirty quarts of red currants, and twenty quarts of strawberries, are how many quarts in all? How many pints?

Market Prices*

Wheat	$0.90	Pears	$1.75	Beets	$0.10
Rye	.65	Plums	1.25	Calves	.12
Oats	.45	Cherries	.10	Lambs	.18
Corn	.70	Grapes	.35	Chickens	.14
Buckwheat	1.00	Potatoes	.55	Turkeys	.18
Cloverseed	.40	Sw. Potatoes	.60	Ducks	.15
Apples	2.50	Turnips	.50	Geese	.12
Peaches	1.10	Onions	.60	Milk, 100 lbs.	1.75

Mr. Harry Handy, an enterprising young man holding a clerkship in an eastern business house, invested his earnings in a western farm. The third year after taking personal charge of the farm he marketed the following products.

If Mr. Handy's sales were all made on the basis of the market quotations above, how much did he realize on each item, and what were his total receipts for the year?

Wheat	550	bu.	Milk	47300	lbs.
Rye	60	"	Potatoes	273	bu.
Oats	725	"	Sw. Pot's.	14	"
Corn	1030	"	Turnips	9	"
Buckwheat	15	"	Onions	11	sacks
Cloverseed	120	lbs.	Beets	152	bunches
Apples	145	bbls.	Calves	396	lbs.
Peaches	62	bu.	Lambs	232	"
Pears	18	"	Chickens	275	"
Plums	3	"	Turkeys	147	"
Cherries	16	bxs.	Ducks	85	"
Grapes	38	bas.	Geese	72	"

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*Prices of farm commodities are governed largely by the locality and the season. The prices scheduled here, as also on page 162, are given as approximate or average prices.

In the equipment of his farm, Mr. Handy had many necessary purchases to make. Some of the most important of these are enumerated on the margin of this page.

Horses
Cows
Sheep
Pigs
Harness
Wagons
Plows
Harrows
Hoes
Spades
Shovels
Pitchforks
Hammers
Hatchets
Axes
Saws
Augers
Nails
Scythes
Grindstone
Wheel Barrow
Saw Horse
Fence Wire
Nuts
Bolts
Mower
Reaper
Hay Rake
C. Planter
Bu. Baskets
½ bu. Meas.
Pk. Measure
Qt. Measure
Sacks

1. Mr. Handy's first purchase included four work horses, and for these he paid, respectively, $135.00, $110.00, $87.50 and $125.00. What was the total amount paid for horses?

2. Having several fields well suited for pasture, he bought nine carefully selected cows, as follows: 4 Jerseys at an average price of $60.00, 3 Holsteins at $48.50 each, and 2 Alderneys at $45.00 each.

3. He also bought 24 Cotswold sheep at an average of $12.00 each; and 10 Berkshire pigs, five months old, for which he paid $37.60 for the lot. What did his sheep and pigs cost?

4. Mr. Handy found three farm wagons necessary, and for these he paid as follows: 1 heavy road wagon with 3 inch tires, $97.50. 1 light market wagon with 1½ inch tires, $68.75 and one wagon especially designed for delivering milk to a neighboring creamery, $71.00. What was his investment in wagons?

Spring Chicken	$0.18	Beets	$0.10	Lettuce	$1.25
Eggs	.22	Early Squash	.25	Celery	.20
Early Potatoes	.65	Early Peas	.08	Watermelons	.10
Radishes	1.20	Strawberries	.12	Cantaloupes	.05
Early Onions	.90	Blackberries	.15	Tomatoes	.35
Cucumbers	.40	Raspberries	.12	Cabbage	1.60
String Beans	.45	Gooseberries	.15	Horse Radish	.10
Carrots	1.00	Currants	.14	Spinach	.50

Mrs. Handy likewise was industrious, frugal, and enterprising. The garden and the hennery afforded her the opportunity. The second season was productive, and she marketed the following at the prices indicated above.

What amount did she receive for each item, and what were her total receipts for the season?

Spring Chickens	64	lbs.	Strawberries	214	bxs.
Eggs	276	doz.	Blackberries	43	"
Early Potatoes	38	bas.	Raspberries	96	"
Radishes	112	bunch.	Gooseberries	20	"
Early Onions	79	sacks	Currants	36	"
Cucumbers	56	bxs.	Lettuce	148	cases

Beets	182	bunch.	Celery	102	bxs.
Early Squash	29	"	Spinach	53	tubs
Early Peas	43	lbs.	Watermelons	104	
String Beans	37	bxs.	Cantaloupes	316	
Carrots	55	bunch.	Cabbage	127	crates
Tomatoes	91	bas.	Horse Radish	35	roots

Various articles are required in the equipment of a home. Mrs. Handy's purchases were many. Mention of some of these will be found on the margin of this page.

Beds
Bedding
Stoves
Tables
Chairs
Dishes
Cutlery
Spoons
Pots
Kettles
Pans
Trays
Tubs
Brooms
Dusters
Carpets
Rugs
Clocks
Pictures
Book-rack
Ink-Stand
Sewing Mach.
Lamps
Writing Desk
Ice-Box
Curtains
Ironing Board
Clothes Basket
Bread Box
Mirrors
Irons
Towels
Calendar

1. What was the cost of three bedsteads, 1 at $33.50, 1 at $27.25, and 1 at $18.00?

2. Of 3 bedsprings at $14.00 each?

3. Of $\frac{3}{4}$ dozen sheets at 90 cts. each? 6 yds. ticking at 30 cts. each? and ten pillow slips at 24 cts. each? $\frac{1}{2}$ dozen blankets at $4.50 each, and $\frac{1}{4}$ dozen bedspreads at $1.50 each?

4. Of 1 kitchen stove at $32.50, 1 parlor stove at $22.00, and 1 hall stove at $16.25?

5. Of 1 dining room table at $21.60, 1 parlor table at $16.00, and 1 sewing table at $5.25?

6. Of $\frac{1}{2}$ dozen dining room chairs at $2.50 each, $\frac{1}{2}$ dozen parlor chairs at an average of $7.50 each, 4 bedroom chairs at $1.75 each and 2 kitchen chairs at $1.50 each?

7. Of 1 pantry and kitchen outfit at $12.50, 1 set dishes at $20.00 and of other dining room accessories at $5.75?

Find the sums:

1.	79,640	2.	31,420	3.	56,329
	32,825		96,793		57,931
	21,193		87,171		83,822
	74,632		73,612		68,736
	60,219		37,137		41,327
	21,521		28,942		83,438

Find the differences:

1.	876,391	2.	743,962	3.	567,981
	432,573		614,271		498,432

4.	1,384,652	5.	3,219,430	6.	7,962,431
	879,610		1,637,891		5,617,381

Find the products:

1.	329,160	2.	497,386	3.	398,645
	45		121		232

4.	1,738,692	5.	2,681,490	6.	3,582,674
	52		120		237

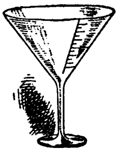
Find the quotients:

1. 32)861,184
2. 121)432,212
3. 220)1,960,640
4. 321)2,743,908
5. 47)813,664
6. 92)624,128
7. 98)3,691,856
8. 385)4,265,800
9. 85)379,440
10. 55)692,835
11. 311)5,329,607
12. 522)6,843,942

Some medicines, and other powerful or costly liquids, are often measured in drops. The druggist calls sixty drops a drachm (pronounced dram). Teaspoons are often so made that a spoonful is equal to a drachm.

1. How many drops are there in six such spoonfuls? —in eight? —in ten?

2. Two dozen such spoonfuls are equal to one gill, which is generally half a teacupful. Gill measures of tin or glass are sometimes used in the kitchen, since recipes for cooking frequently call for one gill. How many such spoonfuls are there in three gills? In eight? —in twelve?



3. Four gills, or generally two teacupfuls, make one pint. How many gills are there in three pints? —in five pints? —in one and one-half pints?

4. Two pints are equal to one quart. How many pints are there in six quarts? —in ten quarts? —in five quarts?

5. How many gills are there in a quart? How many teacupfuls, generally? How many spoonfuls, of sixty drops each?

6. If a quart of cream costs twenty cents, how much is that for each gill?

7. A pint of water or of watery pulp of fruit is generally counted as weighing about a pound. About how many pounds will five quarts of boiled berries weigh?

8. If the fruit be made into preserves, and a pound of sugar be used for every pint of the boiled fruit, about how many pounds will the materials weigh?

9. If two quarts of boiled quinces be added to six quarts of boiled apples, and sugar be added to make preserves in the same proportion, about how much will the materials weigh?

10. Four quarts make one gallon. How many gallons are there in thirty-two quarts? —in 72 quarts?

11. If a bucket containing two gallons of water loses a pint of it by evaporation and a quart by leakage, how much water is left in it?

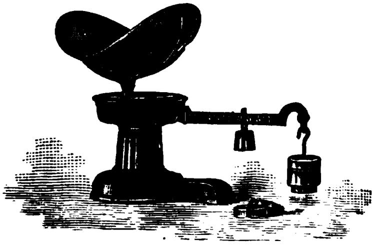
12. If a gill of oil be saved every day by a more careful use of lamps, how much oil will be saved in one hundred days?

13. How many teaspoonfuls of blueing are there in a quart of the fluid if each teaspoonful contains sixty drops?

14. If a gill of ink will supply four ink wells, how much ink will be required for four hundred eighty ink wells?

15. If a quarter of the ink in the ink wells is lost by evaporation, how much might be saved by reducing the evaporation one-half, by keeping the ink wells covered when not in use?

16. If a manufacturer sells one thousand bottles of vinegar, each containing a quart, how many gallons does he sell?—how many pints?



The scale in the grocery store has a bar with notches to indicate ounces, and with marks to indicate pounds, half-pounds, and quarter-pounds. A weight is swung to the bar in such a way that it may rest in any niche; and the further out it is from the hinges of the bar, the greater the weight it will indicate. The object to be weighed is placed in a scoop, or on a small platform, which rests on the weighing instrument.

This scale does not make note of anything less than an ounce. It would not answer at all for weighing diamonds or gold or silver, or medicine that must be taken in very small quantities. It is used for coarse and heavy articles like meat, grain, vegetables, etc. Such articles are bulky and cheap in comparison with jewels and precious metals; and exactness in weighing them is not important as in the case of medicines. It would be a waste of time to weigh them with such exactness as to consider the fractions of an ounce.

1. By means of a pole, John and Harry are carrying a basket, the handle of which rests on the middle of the pole. The basket weighs eighteen pounds. How much of the weight does each boy carry?

2. If the basket be moved so that it is nearer to Harry's end of the pole than it is to John's end, which boy will have the greater weight to carry? If Harry's burden is twice as heavy as John's what is the burden of each?

3. If 7,000 grains of wheat weigh a pound, what number of grains will weigh a half-pound?

4. There are sixteen ounces in the pound. How many grains will there be in each ounce?

5. Mr. Brown has an old wagon with tires one inch wide. Mr. Jones has a wagon with tires three inches wide. The wheel tracks of Mr. Jones' wagon are how many times as wide as those of Mr. Brown's?

6. Both wagons bear the same weight. One inch in width of track has to bear all the weight of Mr. Brown's wagon. What part of the weight of Mr. Jones' does it have to bear?

7. If two horses draw a wagon load consisting of forty bushels of wheat, and each bushel weighs sixty pounds, how much of the load does each horse draw, leaving out of account the weight of the wagon, the sacks, the driver, etc.?

8. The English stone is a measure of weight equal to fourteen pounds. A barrel of salt weighs twenty stone. How many pounds does it weigh?

9. A young student at Eton, in England, weighs 6½ stone. How many pounds does he weigh?

10. If 150 pounds of garden seeds be wrapped in half-pound packages, how many packages will there be?

11. A barrel of flour, for a long period, has weighed one hundred ninety-six pounds, to make an even number of stone. How many stone has it weighed?

12. A farmer sells thirty bushels of navy beans to a grocer. At sixty pounds the bushel, how many pounds will they weigh?

13. A grocer buys forty bushels of onions. They are found to weigh one thousand nine hundred pounds. What did each bushel weigh?

14. Six bushels of sweet potatoes were found to weigh three hundred thirty pounds. What did each peck weigh?

15. A grain dealer bought three hundred forty bushels of corn, in the early fall, by weight, calling seventy pounds a bushel. Weighing it again, at about Christmas time, he found that every bushel weighed two pounds less, because of the drying up of the moisture. What did the grain weigh now? If he sold the corn by weight at sixty-eight pounds the bushel, how many bushels did he sell?

16. If a bushel of corn in the ear weighs sixty-eight pounds, and a bushel of shelled corn weighs fifty-six pounds, what is the difference between the weight of one hundred bushels of shelled corn and one hundred bushels of corn in the ear?

17. If a bushel of cranberries weighs thirty-three pounds, what is the weight of one pint of the berries?

18. A poor tenant buys coal by the bushel basketful. Twenty-five of these ought to equal one ton. But if only twenty-three bushels are actually delivered in the twenty-five deliveries, how much does the buyer lose?

19. A certain Percheron horse weighs eighteen hundred pounds. A certain African elephant weighs three times as much. What does it weigh?

20. A dealer in flour donated five barrels to be divided equally among seven poor families. How many pounds did each receive?

21. He also donated a sack of coffee, weighing forty pounds to be divided among thirty-two poor families. How much did each of the families receive?

22. If by loitering, ten pupils lose each ten minutes every school day for two weeks, how much time is lost by them all?

23. If one hundred twenty pounds of clover seed be put up in eight-ounce packages, how many of these will there be?

24. If a paper weight weighs ten ounces, what will sixteen of the same kind weigh?

25. In the olden time, when small silver pennies were coined, a pennyweight was equal to the weight of twenty-two and one-half grains of wheat. How many grains could be balanced by twenty of the old silver pennies?

26. The common cent of today is made of copper, tin, and zinc, and weighs about as much as forty-eight grains of wheat. Four thousand three hundred grains of wheat would about equal in weight how many of the cents of today? —how many of the old silver pennies?

1. An elderly lady who was familiar with weeds supplied to a wholesale druggist the following weed products, at the prices stated for the pound:

15 lbs. of burdock root at 5 cts.
2 lbs. of burdock seed at 8 cts.
10 lbs. of dock root at 7 cts.
20 lbs. of couch grass at 6 cts.
10 lbs. of pokeroot at 5 cts.
8 lbs. of poke berries at 5 cts.
2 lbs. of fox glove, at 7 cts.
5 lbs. of mullein flowers at 50 cts.
15 lbs. of mullein leaves at 4 cts.
25 lbs. of tansy at 5 cts.
20 lbs. of boneset leaves and tops at 8 cts.
20 lbs. of catnip tops and leaves at 6 cts.
12 lbs. of hoarhound at 6 cts.
10 lbs. of jimson weed leaves at 6 cts.
2 lbs. of jimson weed seeds at 6 cts.
10 lbs. of wormseed at 8 cts.
What did she receive in all for these weed products?

2. A schoolboy sold to a druggist seeds of the following weeds at the prices stated:
Mustard, 10 lbs. at 6 cts.
Lobelia, 10 lbs. at 18 cts.
Burdock, 5 lbs. at 10 cts.
Jimson weed, 5 lbs. at 8 cts.
Wormseed, 4 lbs. at 8 cts.
What did he receive in all for these seeds?

3. A schoolgirl sold to a druggist the following weed products, at the prices stated for the pound:

10 lbs. of wormseed at 7 cts.
25 lbs. of poison hemlock leaves at 4 cts.
10 lbs. of blessed thistle at 10 cts.
15 lbs. of hoarhound at 8 cts.
20 lbs. of catnip leaves at 8 cts.
20 lbs. of jimson weed leaves at 8 cts.

What did she receive for them in all?

4. A fruit vender sells to a family the following fruits at the prices stated for the dozen:

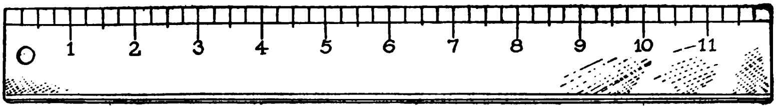
4 dozen bananas at 25 cts.
4 dozen plums at 30 cts.
2 dozen oranges at 30 cts.
½ dozen pineapples at $2.40.
1 dozen cantaloupes at $2.40.

What is the cost of the fruit in all?

A groceryman shipped the following cereals by parcel post to an out of town customer:

5 pkgs. Quaker Oats at 10 cts. the pkg.
4 pkgs. Rolled Oats at 11 cts. the pkg.
3 pkgs. Wheatena at 15 cts. the pkg.
6 pkgs. Cream of Wheat at 14 cts. the pkg.
3 pkgs. Grape Nuts at 13 cts. the pkg.
4 pkgs. Shredded Wheat Biscuit at 12 cts. the pkg.
2 pkgs. Puffed Rice at 13 cts. the pkg.
3 pkgs. Post Toasties at 10 cts. the pkg.

What was the total charge for these goods?



Foot rule reduced to one third of true length.

1. With a ruler, draw a line one inch in length.

2. With a ruler, draw a square measuring one inch each way. This is called a square inch.

3. Draw three square inches in a row.

4. Draw a square measuring three inches each way. This is called three inches square. How many square inches are there in it?

5. What is the difference between three square inches and three inches square?

6. Length, breadth, and thickness are called *dimensions*. A book has length and breadth. Has it also the other dimension?

7. In measuring a string, how many dimensions do we consider? (A string has really all three dimensions, but we do not consider them all in measuring it.)

8. In measuring a rug for a room, how many of the dimensions do we consider? Does a rug really have all three of the dimensions?

9. In measuring a box to find how much it will hold, how many of the dimensions do we consider?

10. How great a length of barbed wire is needed to reach around a square field measuring a quarter-mile each way?

11. If the barbed wire fence runs up and down

steep hills, will it require more wire than would be required on level ground, to inclose the same number of acres? Draw a diagram showing a line of fence on hilly land. Draw a diagram showing a line of fence on level land.

12. Charles had 4 pieces of strong twine, each 120 feet long. 6 inches of their length was lost in tying them together to make one long kite string. If the string was then cut in two in the middle, to make two kite strings, how long was each of these? If 60 feet of string were now added to each, how long would it be?

13. Starting with your right foot, and counting one for every time your left foot touches the walk, count the double steps you take in coming directly from your home to the schoolhouse.

14. In like manner, count the double steps you take in going exactly a mile, according to some well-known boundaries in your neighborhood.

15. There is a garden one hundred feet long and fifty feet wide. What length of fence is required to inclose it?

16. Another garden, having twice the length of this, has but half the width. What length of fence is required to inclose it?

17. If your shoe is eight inches long, how many shoe lengths will measure exactly ten feet?

18. A telegraph wire, stretched on poles on a straight line, joins two towns twelve and one-half

miles apart. What length of wire will be required in all for four wires strung on the same poles?

19. After measuring a porch with a ruler that he supposed to be one foot, or twelve inches, long, a man declared the floor to be sixteen feet long, and eight feet wide. But the ruler which he used was really fourteen inches long. How long was the porch? How wide was it?

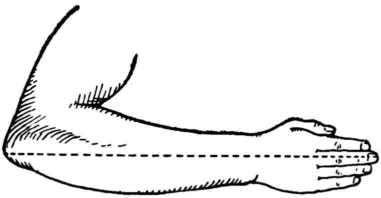
20. If three kite strings, each three hundred fifty feet long, be tied together to form one, how long will it be? There are three feet in one yard. How many yards will the string contain?

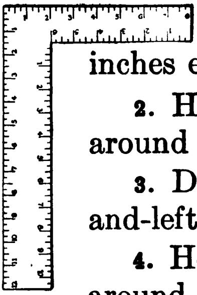
21. The sidewalk in front of a house is the length of ninety bricks, and each brick is eight inches long. The sidewalk is how many feet long?

22. At a certain hour of the day, a straight stake twelve inches tall casts a shadow two inches long. The stake is how many times as long as the shadow?

23. At the same time a flagstaff casts a shadow ten feet long. How tall is the flagstaff?

24. The cubit was a very ancient measure of length, and was originally the length of a man's fore-arm, from the elbow to the end of the middle finger. Two cubits of the ancient Hebrews equaled about thirty-five inches. What was the length of a man's forearm among those people?





1. Draw a square measuring two inches each way, to represent a square mile.

2. How many miles does it take to go around a square mile?

3. Divide the square in halves by a right-and-left line. This is called a horizontal line.

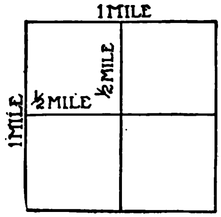
4. How many miles does it take to go around half a square mile?

5. Divide the halves equally by an up-and-down line. This is called a perpendicular line.

6. How many miles does it take to go around a quarter of a square mile?

7. Is half a square mile the same as a square half-mile? If not, what is the difference between them?

8. Divide one of the quarters of the square into quarters.



9. What part of a square mile will each of these be?

10. What length of fence does it take to go around a sixteenth of a square mile?

11. Is a quarter of a square mile the same as a quarter-mile square?

12. One-eighth of a mile is forty rods. If a block and a street crossing are equal to 40 rods, how many blocks and crossings do I pass in going a mile and a half?

13. There are 5280 feet in a mile. If in taking a double step a man advances 5 feet, how many double

steps will he take in a mile? How many single steps will he take in the same distance?

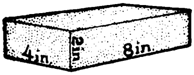
14. If a pavement is made of bricks placed end to end, and three bricks equal two feet in length, how many bricks must there be in a row fifty feet long?

15. If three rows of bricks have a width of one foot, how many rows must there be for the pavement if it is five feet wide, inside the curb?

16. How many bricks will be required to make such a pavement, inside the curb?

17. If the bricks are laid on their edges, and six of them have a width of one foot, how many rows will there be?

18. How many bricks will there be then in the pavement?



19. Common bricks are eight inches long and four inches wide. Can you arrange eight of them to form a perfect square? If so, draw a diagram of them, allowing a half-inch to represent an inch.

20. Can you place one row of bricks all around a square which is twenty inches each way, without breaking a brick? If so, draw a diagram and show how this can be done. (The bricks may be drawn of any convenient length.)

21. If a pavement is made of stone blocks five feet square, how many will be needed for a pavement 5 feet wide in front of a lot fifty feet wide?

22. A common brick has how many square inches of surface?

23. Draw another square, measuring two inches each way, to represent a square mile.

24. Connect the opposite corners with lines drawn through the square. Lines so drawn are called *diagonal* lines.

25. If there were streets around the square mile, and a diagonal street cut through it, which way would be the shorter—to walk from one corner to the corner diagonally opposite along the diagonal line, or along two sides of the square?

26. Diagonal streets are apt to be called avenues. Of what value are such streets in a city?

27. Is the diagonal distance equal to the side of a square block? Is it longer or shorter?

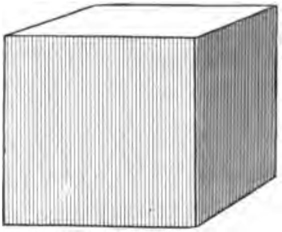
28. Cut out the square that you have last drawn, and divide it into quarters by cutting it along the diagonal lines.

Can you re-arrange these quarters so as to make two perfect squares?

29. Cut each of the quarters into two equal triangles. Can you re-arrange these triangles so as to make four perfect squares?

30. Draw two squares, and divide each into halves by cutting along a diagonal line. Can you then arrange the four pieces to form a single square?

31. If each of the squares that were cut measured an inch each way, how much will the single square contain?

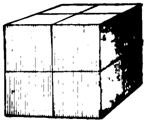


1. Here is a picture of a cube. How many faces has a real cube? How many of its faces can you see at one time?

2. The faces of a cube are all equal. How many of them are really one inch square, as drawn in the picture? Are the others drawn so as to *look* as if they were square in the real cube? Are they drawn so as to look as if they were *equal* in the real cube?

3. How many edges has the cube?

4. If each edge measures one inch, what is the length of the edges altogether?



5. What is the smallest number of cubes of equal size that you can put together each way to form a new cube? Draw the new cube. How many of the small cubes will it contain?

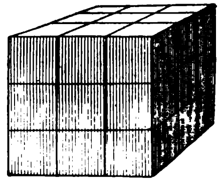
6. If each of the smaller cubes measures one inch each way, (forming thus a *cubic inch*), what will the new cube measure each way?

7. Will it have any more edges than one of the small cubes has?
What will be the length of its edges, in all?

8. Will it have any more faces than the small cube has?
What will be the area of its faces, in all?

9. How many times the weight of one of the small cubes will it have?

10. How many times the surface of one of the small cubes will it have?



11. What is the next smallest number of cubes of equal size that you can put together each way to form a new cube? Draw the new cube.

12. How many of the small cubes will it contain?

13. If each of the smaller cubes measures one inch each way, what will the new cube measure each way?

14. What will be the length of its edges, in all?

15. What will be the area of its faces, in all?

16. How many times the weight of one of the small cubes will it have?

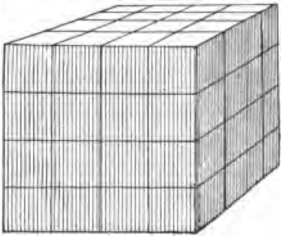
17. How many times the surface of one of the small cubes will it have?

18. A cubic yard measures three feet each way. It is three feet long, three feet wide, and three feet deep. How many square feet does each of its faces contain?

19. Since there are six faces to a cube, how many square feet do the faces of a cubic yard have in all?

20. What are cubic feet? How many are there in a cubic yard? To find the number we must multiply together the figures of all the three dimensions.

21. A cubic yard of earth or of other material need not be in the shape of a cube. It may be shoveled loosely into a wagon. A cubic yard of earth is reckoned as a wagon load. How many wagon loads are there in 270 cubic feet? In 540 cubic feet?



22. What is the next smallest number of cubes of equal size that you can put together each way to form a new cube? How many of the small cubes will there be in the new cube?

23. If each of the smaller cubes measures one inch each way, what will the new cube measure each way?

24. What will be the length of its edges, in all?

25. What will be the area of its faces, in all?

26. How many times the weight of one of the small cubes will it have?

27. How many times the surface of one of the small cubes will it have?

28. The cord is used in measuring fire wood. It is eight feet long, four feet high, and four feet wide. How many cubic feet does it contain?

29. How many cords are equal to 216 cubic yards?

30. If you make a coal bin twice as long, twice as broad, and twice as deep as it is now, it will hold how many times its present amount? How many times the present amount of boards will be used?

To draw a circle with a pair of compasses, place one point of the instrument where the center of the circle is to be, and move the other around it, making an evenly curved line. Or a light cord may be used. One end of this is to be fastened to a pin stuck in the paper, and the point of the pencil is to be fastened in a loop in the cord. The pencil point is then to be carried all around the pin, keeping the cord drawn tight. In making a circle on the ground, one pointed stick will answer for the pin, and another for the pencil, and a stouter cord may be used. A straight line drawn through a circle passing thorugh the middle of it, is called the *diameter*.

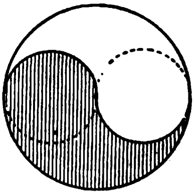
1. Draw a circle with the curved line two inches from the central point. How long is the diameter'?

2. The curved line of a circle is not easy to measure; but we know that it is always about $3\frac{1}{7}$ times the length of the diameter. What is the length of the curved line of a circle having a diameter of seven feet? —of fourteen inches?

3. The trunk of a tree is twenty-one inches in diameter. How large around is the tree?

4. Willie rolls a hoop that is three feet in diameter. How far will it have gone when it shall have turned around seven times?

5. Inside the circle which you have drawn, draw two circles having each a diameter one-half as long. What will be the length of the curved line of each of these small circles?



6. Rub out the upper (dotted) line of one small circle, and the lower one of the other, and shade with cross lines one of the two parts of the drawing. This will form a *claw*, which is a pretty form for a flower bed where two kinds of flowers are planted. What will be the length of the two half-circles forming the double curve?

7. What will be the length of all the lines of the figure?

8. If the diameter of the circle were twice as large as it is, the circle would be four times as large, for it would be twice as long and twice as wide as it is. If the diameter were three times as large as it is, the circle would be how many times as large as it is?

9. If the diameter of the circle were ten times as large as it is, the circle would be how many times as large as it is?

10. A circular lake is one mile across. How long is its stretch of shore?

11. Another circular lake is four miles across. How long is its stretch of shore?

12. The larger lake is how many times as large as the smaller?

13. A six-inch stove pipe is how much larger around than a four-inch stove-pipe?

14. The outer part of a wheel has to move faster than the central part, because it has so much farther to go in the same time. A point on the rim of a factory wheel seven feet in diameter moves how far while the wheel turns once around? A point one

foot from the center of the wheel moves how far in the same time?

15. If a croquet ball be cut in two, each half will have two sides. One of the sides will be flat, or plane, and the other will be curved. It is not easy to measure the area of a curved surface; but we know that the curved side will have exactly twice the area of the plane side.

The half ball will have a total area equal to how many times that of the plane side?

16. Before the ball was divided, its surface was equal to how many times the area of one of the plane sides?

17. If the croquet ball be cut into four equal parts lengthwise, each one of the quarters will have two plane sides and one curved side. The area of the two plane sides will exactly equal that of the curved side. The area of the two plane sides will be what part of the area of the undivided ball?

18. If four round apples be cut in halves, the areas of their curved sides, added together, will equal how many times that of their plane sides?

19. If six round apples be cut in quarters, lengthwise, how will the combined areas of their curved sides compare with those of their plane sides?

20. How many round apples must be cut in two in order that the area of their plane sides may equal the surfaces of twelve whole apples of equal size.

Some clocks have long pendulums that beat once every second. Some clocks tick twice every second. Some watches have second hands to mark the seconds on a little circle.

1. There are sixty seconds in a minute. How many are there in a quarter of a minute? In a half of a minute? In one and one-half minutes?

2. If your pulse beats seventy-five times in a minute, how many times does it beat in twenty seconds?

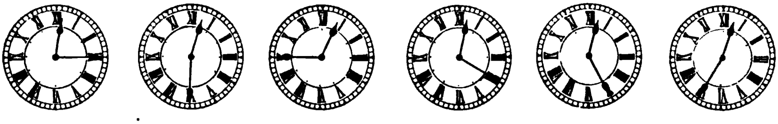
3. Light travels 186,300 miles in a second. How far does it travel in one-fifth of a second? Can you bring down separately all the fingers of one hand on your desk in one second? If so, you can divide the second into fifths.

4. How far does light travel in three-fifths of a second?

5. Sound travels in dry air 1,087 feet in a second. How far will it travel in ten seconds? In five seconds? In three seconds?

6. If you hear the thunder five seconds after the lightning flash, how far away was the flash?

7. If you hear the report of a cannon two seconds after it is fired, how far is it away?



1. When a new hour begins, the minute hand of the clock points directly upward; and in every succeeding minute it passes over one of the minute spaces in the outer circle of the clock face. To what numeral does it point fifteen minutes after the hour begins?

2. To what numeral does it point half an hour after the beginning? —three-quarters of an hour from the beginning?

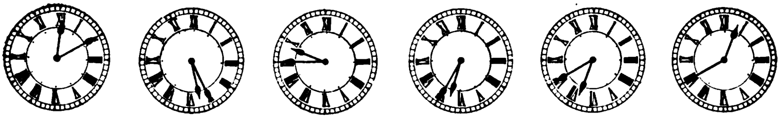
3. Where does the minute hand point twenty minutes after the beginning? —twenty-five minutes after the beginning? —thirty-five minutes after the beginning?

4. Where does the minute hand point ten minutes after the beginning? —forty-five minutes after the beginning?

5. There are sixty minutes in an hour. Thirty-five minutes after the beginning of one hour there remain how many minutes before the beginning of the next hour?

6. Forty minutes after the beginning of one hour, there remain how many minutes before the beginning of the next hour?

7. In stating the time at any minute before the first half-hour is ended, we use the word *past*. When



the hour hand has passed the numeral II, and the minute hand has passed over twenty of the minute spaces, we say that it is "twenty minutes past two." What time do we say it is when the hour hand has passed the numeral V and the minute hand has passed over twenty-five minute spaces?

8. At any time in the last half of the hour we may count forward to the next hour. We state how many minutes the time lacks of the beginning of the next hour; but we omit the word *lacks*. We say it is "ten minutes of three" when it is fifty minutes past two. What time do we say it is when the hour hand has passed the number IX, and the minute hand has yet fifteen minute spaces to pass over?

9. The number of the hours and the number of the minutes may be stated together, briefly. Thus 10:15 means fifteen minutes after ten; and 10:40 means forty minutes after ten, or twenty minutes of eleven. What is the meaning of 6:35?—of 8:45? —of 7:30? —of 4:40? —of 9:25? —of 12:20?

10. What is the meaning of 3:45?—of 4:20?—of 10:15?

11. The minute hand moves entirely around the circle in every hour. How many times does it move around the circle in twenty-four hours?

1. There are seven days in the week. How many days are there in eight weeks? —in ten weeks? —in six weeks?

2. How many weeks are there in forty days? —in forty-nine days? —in fifty-six days? —in sixty-two days?

3. There are fifty-two and one-seventh weeks in the year. How many weeks are there in fourteen years?

4. The moon travels around the earth in twenty-eight days. How many such revolutions does it make in a year?

5. A fortnight is fourteen days. How many days are there in twenty fortnights?

6. There are twelve months in the year. How many months are there in four years?

7. January, March, May, July, August, October, and December have each thirty-one days. How many days have these long months in all?

8. February has generally twenty-eight days; and April, June, September, and November have each thirty. How many days have these short months in all?

9. Spring includes March, April, and May. Summer includes June, July, and August. Autumn includes September, October, and November. Winter includes December, January, and February. How many days are there in each of the four seasons into which the year is thus divided?

10. There are ten years in a decade. How many decades were there between the Louisiana Purchase of 1803 and the Emancipation Proclamation of 1863?

11. The Greek Olympiad was a period of four years. How many Olympiads were there between the year 776 before Christ and the year 326 before Christ?

12. The term of a president is four years. How many terms are there in four score years?

13. In Tennyson's poem "The Voyage of Maeldune" we read:

> "Then we came to the isle of a saint who had
> sailed with St. Brendan of yore,
> And had lived ever since on the isle, and his
> winters were fifteen score."

How many years old was the saint, according to this legend?

14. A mischievous bluejay carried away from a barn 2 staples, 4 harness buckles, 4 nails, 7 screws, and 3 small bundles of seeds, hiding them in 4 places. How many articles did it hide in each place, if they were divided equally?

15. Proverb tells us that oysters are in season in every month that has the letter *r* in its name. How many such months are there? How many months are there whose names do not contain the letter *r*?

16. *December* means "tenth month." But December is really the twelfth month. How far has it been moved from its old place in the year?

1. A machine is improved so as to save two seconds of time in every minute. There are sixty minutes in an hour. How many seconds are saved every hour by the new machine? How many seconds are saved in a working day of eight hours?

2. If one minute in every hour is saved by a better arrangement of your work, how much time is saved in this way in the hours of school in a day? In a week?

3. If a railway train travels at the rate of forty-five miles an hour, how many miles does it go in five minutes? —in ten minutes? —in one minute?

4. If you read a page in two minutes, how long will it take for you to read a book of two hundred forty pages?

5. If a working day is eight hours in length, how many hours are there in three hundred working days?

6. If you rise at six and retire at ten, how many hours of activity have you in a day? How many of rest?

7. In a sand glass to keep time in boiling eggs, the sand will run out in three minutes. How many times must the sand glass be turned in an hour if it is used all the time?

8. A man had two watches. One ran too fast and gained 2 minutes every hour, and the other ran too slowly and lost 4 minutes every hour. If the two watches were started together at the right time, how far apart were they at the end of five hours?

9. At a certain point to the east of us, it is noon by the sun one hour earlier than it is noon where we are. What time is it there, by the sun, when it is noon here?

10. At a certain point to the west it is noon by the sun one hour later than it is noon here. What time is it there, by the sun, when it is noon here?

11. If Elihu Burritt, "The Learned Blacksmith," found time to study a subject thirty minutes every working day, how much time did he find for this work in a year of three hundred thirteen working days?

12. If the wind is blowing at the rate of twenty miles an hour, what part of a mile does it blow in a minute? How long does it take to pass over one mile?

13. If Mrs. Jones's watch, starting right, gains one and one-half minutes a day for ten days, and is then set back twenty minutes, how much too slow is it then?

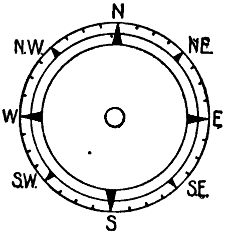
14. A broken cog in a machine causes it to lose a fifth of a second every revolution. How much time does it lose in 50,000 revolutions?

15. If your pulse beats seventy times in one minute, how long does it require to beat 4900 times.

16. If a merchant sells one hundred twenty bottles of olive oil each containing one quart, how many gallons does he sell?

The directions are indicated by an instrument called the compass. The various points of direction are called *"points of the compass."* The points are marked on a circle, in the center of which is a pivot on which a steel needle is balanced so that it will swing easily to the right or to the left. The needle will always point exactly or nearly to the north, because it is attracted toward a place which is called the electric North Pole.

The compass is used all the time by sailors on the water and by surveyors on the land. In a large part of this country, the people generally do not need to refer to it often, because the boundary lines of farms and fields, and of sections, or square miles, are apt to be north-and-south lines, and east-and-west lines; and because the streets of cities very generally run in the directions of such lines.



To learn the directions in any place is to *orient** oneself. If at sunrise you point your right arm to the sun, and stretch out your left arm in the opposite direction, in what directions will your arms point? What direction will you face? What will be the direction exactly opposite? While you know the directions very well in your own neighborhood, are you ever "turned around" when visiting a strange city or an unfamiliar part of the country, or when you are in the thick woods? How could you orient yourself at sunset if the sun could be seen? Do you know of any way of orienting yourself when the sun cannot be seen?

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*The use of this word is a great convenience and pupils should learn it early. Horace Mann places emphasis upon it.

1. North, South, East and West are called the *cardinal points.* Midway between north and east is what direction? Midway between east and south is what? Midway between south and west is what? Midway between west and north is what?

2. The abbreviation for north is the initial N.; for east, E.; for south, S.; and for west, W. News comes to us from all over the world. In the word *news* are the initials of how many directions?

From the four points
of the compass
comes the
NEWS
NORTH EAST WEST SOUTH

3. The abreviation for northeast is N.E.; for southeast, S.E.; for southwest, S.W.; and for northwest is N.W. The names of these directions are not compound words, as we might think from the fact that two letters are used in the abbreviation of each. These directions are called intermediate points.

4. How many cardinal and intermediate points have been named? Write the abbreviation for each of them in order, passing around from north to the right.

5. Draw a compass circle, and indicate on it the cardinal points, printing their initials.

6. Indicate on the circle the four intermediate points, printing their proper abbreviations.

7. How many spaces are there between the points named?

8. In the compass there are three points of direction for each of these spaces. How many points are there, for all these spaces?

9. The names of only eight of the points are given in the picture. How many points has the compass, in all?

10. Sailors and surveyors must learn to name in order all the points of the compass. This is called "boxing the compass." If a sailor "boxes the compass" four times, how many directions does he name?

11. The wind was blowing directly from the west. It shifted four points to the northward. From what direction did it blow then? If it had shifted four points more, from what direction would it then have come?

12. Through how many points of the compass must the wind shift to change from due north to due south?

13. Through how many points of the compass must the wind shift to change from south-east to north-east? From south-east to north-west?

14. Before the compass was invented, men guided their ships rudely by the Pole Star. If this were visible all the time, would it answer as well as the compass for indicating directions?

15. One half of the compass needle is drawn by a strong force to the northward, while the other is repelled to the southward. If the needle be broken in pieces, each piece will be a complete needle, its opposite points being affected as those of the original needle were. If the needle be broken twice, how many needles will there be?

Find the products:

1. 23,469×31
2. 47,932×42
3. 68,745×17
4. 92,861×45
5. 63,512×56
6. 39,862×71
7. 63,514×82
8. 49,328×93

9. 76,485×65
10. 18,962×67
11. 49,723×59
12. 89,611×38
13. 77,322×64
14. 47,896×85
15. 99,620×57
16. 43,821×94

17. 19,375×83
18. 82,713×47
19. 61,309×33
20. 85,460×55
21. 38,924×87
22. 65,117×92
23. 91,590×86
24. 45,609×91
25. 82,431×78

Find the quotient:

1. 49,178÷32
2. 61,396÷61
3. 59,218÷84
4. 72,135÷45
5. 40,386÷73
6. 91,485÷55
7. 87,916÷38
8. 65,391÷62

9. 77,932÷56
10. 58,406÷63
11. 88,415÷85
12. 51,062÷33
13. 76,180÷75
14. 83,915÷65
15. 21,836÷93
16. 66,240÷35

17. 75,108÷59
18. 47,925÷95
19. 63,422÷62
20. 78,319÷48
21. 82,112÷76
22. 35,980÷65
23. 43,628÷39
24. 82,531÷97
25. 96,492÷66

1. Three Iowa students engaged in hunting and trapping sent to a Chicago fur house the following pelts of animals that they had secured in a period of three weeks from November 10th to December 1st, and received the prices indicated:

12 minks at $7.50 each.
75 muskrats at $0.50 each.
3 raccoons at $3.00 each.
1 badger at $2.50.
1 otter at $15.00.
1 silver fox at $400.00.
2 beavers at $6.00 each.
10 black house cats at $0.30 each.
22 mephitis cats (the furs to be known as "Alaska sables") at $2.75 each.

What was the total value of these furs and what was the share of each student when the money was divided equally among them?

2. A farmer boy in Wisconsin sent to a Chicago fur house the skins of the following animals, and received for them the amounts indicated:

1 gray fox at $2.00.
2 timber wolves at $5.00 each.
1 red fox at $6.00.
2 civet cats at $3.00 each.
15 muskrats at $0.40 each.
1 dark marten at $18.00.

What did he receive in all for the furs?

3. An Ohio youth in one season sent to a fur house pelts of the following animals, at the prices stated:

2 white weasels at $1.25 each.
1 lynx at $25.00.
2 wolverines at $5.00 each.
1 brown marten at $9.00.
1 dark fox at $25.00.
6 raccoons at $3.25 each.
30 muskrats at $0.60 each.
1 black fox at $100.00.

What did he receive in all for these furs?

4. An Indiana farmer sent to a furrier the pelts of the following animals at the prices named:

50 muskrats at $0.40 each.
4 white weasels at $0.60 each.
1 wild cat at $1.00.
6 black house cats at $0.25 each.
3 raccoons at $3.00 each.

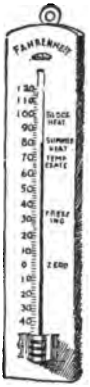
What did he receive in all for these furs?

5. A Wisconsin trapper supplied to a wholesale druggist 2¼ pounds of beaver castoreum at $10 the pound. What did he receive for them?

An Arkansas student sent to a furrier the pelts of

14 raccoons at $3.50 each.
4 opossums at 40 cts. each.
6 white weasels at 50 cts. each.
3 timber wolves at $3.50 each.
22 muskrats at 50 cts. each.

What did he receive in all for these furs?



1. The thermometer shows the degree of heat. This is called the *temperature.* The starting point for counting is called zero, which is indicated by a small circle. How many degrees do you find marked above it?

2. How many degrees do you find marked below zero?

3. There is a mark for every two degrees of heat. How many marks are there between twenty degrees and thirty degrees?

4. Blood heat is 98 degrees above zero, and the schoolroom should have a temperature of 70 degrees. How much is this below blood heat?

5. Ten degrees above zero is how many degrees below the freezing point?

6. Summer heat is eighty degrees above zero. How far is it below blood heat?

7. The temperature of the schoolroom is how many degrees above zero?

8. Water freezes at 32 degrees above zero. How much is this below blood heat? below the temperature of the room?

9. The temperature of the human body is about 98 degrees above zero. How high is it above the freezing point?

10. Four degrees below zero is how many degrees below the freezing point? How many degrees is it below blood heat?

10. Water freezes at 32 degrees above zero, and it boils at 212 degrees above zero, according to the thermometer in general use. How many degrees are there between the freezing point and the boiling point of water?

11. If it is 72 degrees above zero in the schoolroom, and ten degrees above zero in the street, how many degrees warmer is the schoolroom than the street?

12. Since warm air rises to the highest part of a room, it makes a difference where the thermometer is placed. Find the difference between the degree shown when the thermometer is on the floor and when it is as high as you can reach.

13. *Maximum* means greatest, and *minimum* means least. Here is a record of temperature for five school days. It was made on the porch of the schoolhouse. Instead of the word degree, the sign ° is used in the record. The degrees recorded are all above zero.

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:30 A. M.	70°	76°	65°	72°	68°
1:00 P. M.	82°	88°	76°	84°	78°

14. What is the maximum heat recorded?

15. What is the minimum heat recorded?

16. Make a record of your own for one week at the hours indicated.

17. The average, or mean, is half-way between the maximum and the minimum. What was the average temperature for each day?

The Saturday sales of Mr. Harold Smith, a retail groceryman, during a certain week, included the following family supplies. What amount of money did his cashier take in for all of these items?

1.	Butter	37	lbs.	Riverside Creamery	@	$0.28
2.	Eggs	62	doz.	"Strictly fresh" country	@	.22
3.	Cheese	19	lbs.	American	@	.18
4.	Bread	32	loaves	"Mothers"	@	.05
5.	Crackers.	21	lbs.	Soda Premium	@	.10
6.	Maple syrup	49	gal.	Granite State	@	1.55
7.	Apples	120	lbs.	Greenings	@	.07
8.	Peaches	23	bas.	Freestone	@	.35
9.	Pears	5	"	Bartlett	@	.25
10.	Plums	3	"	Michigan	@	.38
11.	Grapes	14	"	Concord	@	.40
12.	Cherries	8	bxs.		@	.15
13.	Potatoes	96	lbs.	Virginia	@	.03
14.	Onions	12	"	White	@	.05
15.	Beets	16	"		@	.05
16.	Turnip	17	"	Yellowsaps	@	.05
17.	Parsnips	14	"		@	.05
18.	Carrots	10	"		@	.03
19.	Chickens	60	"		@	.28
20.	Turkeys	48	"		@	.30
21.	Ducks	26	"	Mallard	@	.17
22.	Geese	28	"	Watertown, each	@	.16
23.	Squabs	½	doz.	the doz.	@	5.00

Mr. Smith's sales of Canned Goods during the same day included the following: What amount did his cashier receive for these items?

Prepared Soups

Consomme (kôn-so-ma)	3 cans	@	$0.10
Bouillon (Bool-yôn)	2 “	@	.10
Ox-tail	5 “	@	.10
Tomato	4 “	@	.10
Scotch Broth	7 “	@	.10
Vegetable	6 “	@	.10

Canned Fruits

Peaches	7 cans	yellow free, 2½ lb.	@	$0.25
Pears	4 “	Bartletts, 3 lb.	@	.35
Apricots	5 “	Extra Standard, 2½ lb.	@	.17
Plums	3 “	California Egg	@	.17
Pineapple	6 “	Hawaiian, (Ha-wi′-ya)	@	.25
Cherries	2 “	Red, 2 lb., pitted	@	.28

Canned Vegetables

Beans	4 cans	Lima, Green	@	$0.22
Peas	3 “	Marrowfat	@	.14
Asparagus	3 “	Golden Crown	@	.25
Spinach	2 “	Bon Vivant (Bon-ve-van′)	@	.18
Succotash	2 “	Butter-Beans and Corn	@	.13
Tomatoes	4 “	Stewed and Strained	@	.15

Dried Fruits

Raisins	6 lbs.	Malaga (Mal′-à-gá) Clusters	@	$0.20
Dates	3 bxs.	Magnums, pitted	@	.25
Figs	4 “	Imperials	@	.35
Currants	5 “	Casalina	@	.12

Note.—Bookkeeping is not a necessary or usual part of the work of the fourth grade; nor is it insisted upon here as obligatory upon the teacher or the school. But so many pupils leave school at the end of the fourth year that it is advisable to afford an opportunity, at least, for a few elementary exercises in the keeping of accounts.

A person who buys something of another becomes a *debtor*, unless he pays immediately for what is bought. He is said to be *in debt* to the amount of his purchase. The old word for debtor was *debitor*, and the old word for debt was *debit*. We still use the word *debit* to mean a single item of *indebtedness*. Thus, if John Brown buys on credit a bridle for $2.00 and a saddle for $6.00, he is a debtor to the amount of $8.00; and there are two debits in the statement of his account. The person to whom a debt is owing is called a *creditor*, because when he receives any payment on the account he *credits* it to the person who pays.

If the bridle and saddle are bought of James Smith, and cash is not paid for them at the time, he is the creditor. The abbreviation for *debtor* is Dr., which is also the abbreviation for *doctor;* so that care must be taken not to confound these two words. The abbreviation for *creditor* is Cr.

To state the transaction in the natural order of words, any one would say "John Brown Dr. to James Smith." But the old order of words, borrowed from the Latin, is "John Brown to James Smith Dr." When the statement is written in this way, we must remember that James Smith is *not* the debtor although the Dr. is written after his name. The old order of these words is still in very general use, so we must be sure to understand it.

If John Brown keeps an account book when he pays James Smith he will charge the cash against Mr. Smith, and will credit Mr. Smith with the goods purchased so that the "debtor" and "creditor" change places exactly in the account kept by the two men.

Here are entries taken from an account book called a journal, in which the debits and credits are entered on separate pages.

John Brown to James Smith Dr.

	1913			
Apr.	1	to 1 bridle	$2	00
"	1	to 1 saddle	6	00

The credits are taken from another page of the account book, and in this case are as follows:

John Brown to James Smith Cr.

	1913			
Apr.	15	By cash	$4	00
May	1	" "	4	00

Here James Smith is not the creditor, although "Cr." is written after his name. These credits show that John Brown paid four dollars on the 15th of April and four dollars more on the 1st of May. A remainder in accounts is called a "balance." When the April payment was made there was a balance of $4.00. When this was paid, in May, the account was "balanced," for the total amount on the "Dr." page was then equal to the total amount on the "Cr." page.

1. On Dec. 1, '12, a jeweler, named Henry Meyer charged S. R. Thompson, $2.00 for cleaning a watch; on Dec. 10, 75 cents for mending an opera glass; on Dec. 14, $6.00 for three napkin rings; on Dec. 20, $9.00 for a set of teaspoons; on Dec. 23, $40.00 for a watch, $10.00 for a necklace, and $5.00 for a silver cup. On Jan. 3, '13, the jeweler received cash for half of the amount due, and on January 10th, he received the balance due. State the items for the Dr. page and the Cr. page of an account book kept by Henry Meyer.

2. Charles Adams boards at the home of Mrs. Clara Newton, and pays five dollars a week for his board. When he pays her, she is the debtor, on his account book, for cash received; and he is the creditor for he credits her with his board. He pays for a week in advance. Beginning with Monday, Sept. 1, 1913, write the "Dr." and "Cr." pages of his account with Mrs. Clara Newton, for four weeks.

3. Write the "Dr." and "Cr." pages of Mrs. Clara Newton's account book relating to Charles Adams for the same period.

4. Mr. Frank Pelton supplies to a nearby academy various products of his farm, and in return his son Harvey receives tuition at $25.00 the term of ten weeks, board at $3.00 the week, room rent at $1.50 the week, laundering at 50 cents the week, library and other allowances amounting to 50 cents the week, and spending

money from the principal, J. F. Adams, amounting to $2.00 the week.

5. Write for Mr. Pelton's account the "Dr." page, and also the "Cr." page; and show on which side there is a balance at the time of settlement. The balance is paid in cash on Nov. 8, '13. The credits for the week are made each Monday morning in advance. The credit for tuition is made at once, at the start.

6. Write for Mr. Adams's account book the "Dr." page and also the "Cr." page, containing the same items of account.

The term begins Monday, Sept. 1, '13. Mr. Pelton supplies to the refectory the following:

	1913			
Sept.	1	50 bu.	potatoes at	$ .65
"	1	110 lbs.	beef at	.12
"	1	8 doz.	eggs at	.30
"	1	118 lbs.	pork at	.12
"	1	30 lbs.	butter at	.30
"	20	10 bu.	white beans at	3.00
Oct.	18	28 lbs.	butter at	.30
"	28	60 lbs.	mutton at	.12
Nov.	1	50 bu.	potatoes at	.80
"	3	6 bbls.	apples at	3.50
"	7	12	pumpkins at	.15
"	9	2	chickens at	.30

1. John Wilson, aged 12, has a Postal Deposit certificate for $1.00 for every week from the beginning of April to the end of June. How manv dollars has he in the Postal Savings System?

2. Mary Wilson, aged 7, has a ten-cent postal savings card, with nine ten-cent Postal Savings stamps on it, and all its spaces are filled. What is it worth?

3. Fannie Wilson, aged 9, has two such cards. One card is filled with nine ten-cent stamps, and the other card has two spaces not yet filled. What are her cards worth?

4. What will her cards be worth when she has filled the vacant spaces with stamps, and bought and filled another card?

5. Frank Wilson, aged 14, has one Postal Deposit certificate for $5.00 and two for $2.00 each. He has one dollar more to deposit, but is not able to go to the Post Office. His sister Mary takes it for him, and receives a Postal Savings certificate for $1.00. What are his Postal Savings certificates now worth, in all?

6. If Frank Wilson keeps each of his certificates for one year from the time when he received it, he will receive $1.02 for every dollar that he paid for it. How much will he receive for all these certificates?

7. If Frank Wilson then adds $1.80 to the amount and buys new certificates, and keeps them for a year, how much will he then receive for them if he desires to draw out the money for use?

7. Mr. Henry T. Wilson, the father, has $500.00 in Postal Deposit certificates, this being the largest amount that any one person is permitted to procure. He has deposited, to draw upon for current expenses, $500 in the First National Bank of his city, and $600 in the Farmers' National Bank. How much has he in all in Postal Deposit certificates and bank deposits?

8. Mr. George F. Murray deposits in the Lohr German Bank of Lurline, on the first day of every month, a check for the amount of his salary during the previous month, which is $125.00. He draws out $50.00 one week later, and $50.00 more before the month is over. How much does he deposit in the year? How much does he draw out in the year? What balance is due him at the end of the year?

9. Mr. Thomas Nelson deposited in the Stockmen's Bank of his city, $200 in January, $300 in April, $250 in July, $400 in September, $900 in November, and $1000 in December. In the course of the year he drew out $1250. What were his total deposits? —his total withdrawals? What balance was there in his favor at the end of the year?

10. Mary Winans deposits $45 in the Centerville Bank each month for nine months, and withdraws $22 in the course of each month. What is due her at the end of the period?

If she cashes also Postal deposit certificate for $16, how much money does she withdraw in all?

Preparatory to establishing his son in the retail fruit and confectionery business, Mr. Nelson obtained from a city wholesale dealer a price list of the goods desired, to aid him in making his first order.

Find the cost of each item in the quantities named below, and the total cost of the twenty-two items.

20 bxs. Chocolate Creams @ $1.15 the box (5 lbs.).
10 bxs. American Cream Almonds @ .85 the box.
12 bxs. Chocolate Marshmallows @ .90 the box.
15 bxs. Bon Bons (assorted) @ 1.15 the box.
10 pails Cuban Nougats @ .90 the pail.
10 3-lb. bxs. Cream Patties @ .70 the box.
15 bxs. Butter Scotch (400 squares) @ .60 the box.
25 bxs. Hoarhound Squares @ .60 the box (5 lbs.).
20 bxs. Lemon Drops @ .60 the box (5 lbs.).
10 bxs. Molasses Mint @ .60 the box (5 lbs.).
10 bxs. Anis Squares @ .60 the box (5 lbs.).
10 bxs. Peanut Taffy @ .60 the box (5 lbs.).
10 5-lb. sheets Cocoanut Taffy @ .12 the sheet.
5 bxs. Molasses Satinettes @ .15 the lb. (5 lbs.).
15 bxs. Cream Filberts @ .65 the box (5 lbs.).
10 bxs. Chocolate Mint Wafers @ .60 the box.
5 cans Butter Cups (nut fillings) @ 1.25 the can.
10 bxs. Peppermint Lozenges @ .60 the box.
10 6-lb. cans Wintergreen Mints @ .15 the pound.
5 bxs. Jelly Gum Drops (assorted) @ 1.00 the box.
5 bxs. Cream Glaces (assorted) @ .85 the box.
10 bxs. Macaroon Almonds @ .65 the box (5 lbs.).

Ascertain the cost of each item named below, at the wholesale market price indicated, and the total cost of the twenty-seven items.

50 bbl. Apples @ $3.50 the barrel.
75 bu. Peaches @ .60 the bushel.
40 bu. Pears @ .65 the bushel.
25 bas. Plums @ .30 the basket.
30 bxs. Oranges @ 3.25 the box.
20 bxs. Lemons @ 3.90 the box.
12 bxs. Limes @ .85 the box.
15 bxs. Grapefruit @ 3.00 the box.
10 bu. Crabapples @ 2.00 the bushel.
12 crates Pineapples @ 3.00 the crate.
10 bxs. Quinces @ 1.50 the box.
20 bas. Prunes @ .20 the basket.
45 bun. Bananas @ 1.25 the bunch.
40 lbs. Apricots (evaporated) @ .15 the pound.
48 bot. Olives @ 5.50 the dozen.
10 cas. Figs @ 1.50 the case.
10 bxs. Dates @ .30 the box.
10 bxs. Raisins @ 4.50 the box.
75 lbs. Almonds @ .15 the pound.
60 lbs. Filberts @ .12 the pound.
85 lbs. Pecans @ .10 the pound.
80 lbs. Brazil Nuts @ .16 the pound.
65 lbs. Eng. Walnuts @ .15 the pound.
50 lbs. Black Walnuts @ .3 the pound.
90 lbs. Peanuts @ .90 the pound.
45 lbs. Chestnuts @ .8 the pound.
250 Cocoanuts @ 5.00 the hundred.

I. Find the sum of the numbers in Problems 1, 2, 3.

II. Subtract the numbers in Problems 4 to 12, as indicated.

III. Multiply the numbers in Problems 13 to 34 successively by 15, by 25, by 60.

IV. Divide the numbers in Problems 35 to 56 successively by 12, by 16, by 48.

1. 57875
43759
61943
50687
69538
42419
85368

2. 63295
98614
57321
79432
36584
83947
64139

3. 59872
42391
76318
62497
93211
81397
74983
52418

4. 57875
43759

5. 61943
50687

6. 69538
42419

7. 85368
63295

8. 98614
57321

9. 79432
36584

10. 83947
64139

11. 59872
42391

12. 76318
62497

13. 57875
14. 95734
15. 34916
16. 78605
17. 83596
18. 91424
19. 86358
20. 59236
21. 41689
22. 12375
23. 23497
24. 48563
25. 74938
26. 93146
27. 27895
28. 19324
29. 81367
30. 78426
31. 11239
32. 79318
33. 38947
34. 81425

35. 27312
36. 40560
37. 54336
38. 59632
39. 71136
40. 76512
41. 78288
42. 83472
43. 88320
44. 92928
45. 94656
46. 79488
47. 81120
48. 82656
49. 73056
50. 66768
51. 68400
52. 81264
53. 35616
54. 45168
55. 61968
56. 89856

Great Industrial Expositions have been held from time to time in different parts of the world, to commemorate important national events. Of these the following were in the United States.

Designation	Place	Year	Attendance
International Centennial	Philadelphia	1876	9,910,966
World's Columbian	Chicago	1893	27,539,014
California Mid-winter	San Francisco	1894	2,250,000
Cotton States	Atlanta	1895	1,179,889
Tennessee Centennial	Nashville	1897	1,886,706
Trans-Mississippi	Omaha	1898	2,613,508
The Pan-American	Buffalo	1901	8,120,048
The Louisiana Puchase	St. Louis	1904	19,694,855
The Lewis and Clark	Portland	1905	2,545,509
The Alaska-Yukon-Pacific	Seattle	1909	3,740,499

1. Copy the numbers in the last column, and find their sum.

2. What was the average attendance at these ten expositions?

3. Find the difference between the largest and the smallest attendance.

4. Find the difference between the next largest and the next smallest attendance.

5. A certain globe, one foot in diameter, weighs ten pounds. If it were three feet in diameter, and made in the same way, it would weigh two hundred and seventy pounds. What would be the difference in weight?

6. A pole forty feet long is set in the ground six feet deep? How tall is the pole above the ground?

7. When a horse is fourteen years old, all of the teeth of its lower jaw have circular tops. When it is twenty years old all of these teeth have three cornered tops. How many years does it take for this change to be made?

8. Every circle, whatever its size, may be divided into 360 degrees. How many degrees are there in a quarter circle?

9. The sign ° means degree or degrees. The sun is at high noon when it has risen from the eastern horizon to its highest point in the heavens. How many degrees high is it?

10. A certain railway train is detained 40 minutes through an accident at a switch; and 15 minutes at a junction, and it loses 15 minutes more in going very slowly through a fog. Then it makes up 20 minutes of lost time by going much faster. How much behind time will it be at the end of its trip?

11. In his Gettysburg Speech in 1863, President Lincoln referred to a notable event of "three-score and seven years" before. How many years did he mean?

12. "Twelfth Night" is the eve of the 12th day after Christmas. What day is it in the calendar?

13. If a man walks 20 miles a day for 35 days, how far does he walk?

14. The author of "Ten Acres Enough" paid $1,000.00 for his farm of eleven acres, including the building on it. How much did he pay for each acre?

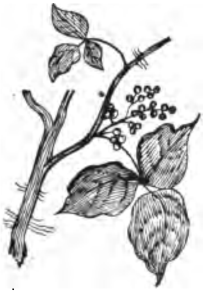
15. It is believed that the loss to crops in the United States by reason of insects amounts to $500,000,000 in one year. How much is this for each month?

16. A square quarter-mile is what part of a square mile?

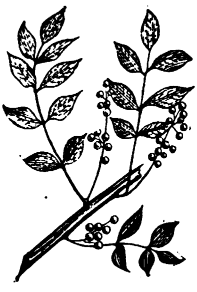
17. A steam launch cost a man $2,400.00. He sold it at a loss of one-quarter of the cost price. Mr. Williams, who bought it, sold it at a gain of one-quarter of the price he paid for it. How much did Mr. Williams receive?

18. If a single mill in Maine uses two thousand cords of paper birch each year in the manufacture of toothpicks, how many cords of paper birch will this mill use in seven and one-half years?

19. In this picture of the poison ivy, how many leaves are there on a branch? How many of the white berries can you count? How many leaves would there be on four such branches? How many berries?



Poison Ivy.



Poison Sumac.

20. In this picture of the poison sumac, how many stems of leaves can you count, and how many bunches of the whitish berries?

21. How many of each would three such branches as this?

22. Of twelve girls who found poison ivy in their walk, six were poisoned in both arms and two in one arm. How many escaped poisoning?

23. Draw a figure of a piece of land one mile square, or one square mile, for they mean the same thing.

Draw a figure of one-half a square mile.

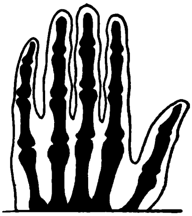
Draw a figure of a square half-mile.

A square half-mile is what part of half a square mile?

24. A piece of ground contains two acres. How many square rods has it?

25. If it is forty rods long, how many rods wide is it? Draw plan.

26. A man owning 4 horses has each of them fully shod anew once in every month. In how many months will the farrier have adjusted 64 horseshoes on the feet of these animals? If he uses 7 nails in adjusting each of these shoes, how many nails does he use in this way in the period stated?



27. By looking through a fluoroscope you can see the bones of your hand. Each of the fingers except the thumb has how many bones?

28. How many bones has the thumb?

29. How many bones are there in all?

30. If one-fifth of a man's salary is paid for rent, and amounts to twenty-five dollars the month, what is his salary for the month? For the year?

31. If a man, dying, leaves a life insurance of $5,000 and $10,000 in real estate, and $2,500 in a savings bank, and $500 deposited in a National bank, how much property does he leave?

32. If the widow receives one-third of the property, how much does she receive?

33. If six children share the balance equally, how much does each of the children receive?

34. One plant of burdock may bear 400,000 seeds. If one in ten of these should develop into a plant in the same field, how many burdock plants would there be?

35. Dandelion root was imported into the United States in 1903 to the amount of 115,522 pounds. At 5 cents the pound, what were the roots worth?

36. The leaves of the Jimson weed are imported into this country in some years to the amount of 150,000 pounds. What are they worth at 5 cents the pound?

37. The population of the Dominion of Canada in 1913 was 7,205,000; of the Dominion of New Zealand, 1,071,000; of the Commonwealth of Australia, 4,455,000. What was the total population of the Dominions and of the Commonwealth?

38. The population of the United States, including the detached possessions, in 1900 was 101,102,000. The population of the Russian empire was 165,829,000. How much the larger was the population of the Russian empire?

39. The total value of the farm products of the United States for the year 1910 was $8,926,000,000. The farm products of the Dominion of Canada for that year were worth $507,185,500. What was the value of the farm products of both countries for that year?

40. In a park there is one pergola, or stone-built arbor, and there are two arbors built of frame work. If each of the arbors has eight vines, how many vines are there in all?

41. In 1910 the cotton crop of the United States, which was the greatest that had ever been known, was worth $900,000,000. The hay crop was worth $720,000,000. The wheat crop was worth $625,000,000. What was the value of these three crops?

42. In the same year the Indian corn crop was worth $1,500,000,000. How much more valuable was it than the cotton crop?

43. In the same year the hay crop of Canada was worth $149,716,000; the oats crop, $114,365,000; the wheat crop, $112,973,000. What was the value of these three Canadian crops?

44. If a traveler spends eight days in journeying from San Francisco to Honolulu, in our Territory of Hawaii, and sixteen days more in going from Honolulu to Auckland, in the Dominion of New Zealand, and six days more in sailing from Auckland to Sydney, in the Commonwealth of Australia, how long a time does he pass on the ocean?

45. In South America there are ten Spanish-speaking nations; in North America there are six; in the West Indies there are two. How many are there in all, in the Western Hemisphere?

46. In the United States there are 48 States and one Federal District. In the Dominion of Canada there are nine Provinces. In Mexico there are twenty-seven States, and one Federal District. How many states, Provinces, and Federal districts are there in all these?

47. The area of the United States, exclusive of detached possessions, is 3,026,789 square miles. The area of the republic of Brazil, in South America, is 3,218,130 square miles. How much larger is Brazil than the United States?

48. The area of the Commonwealth of Australia which includes the states of Tasmania and the territory of Papua, is 3,283,409 square miles. How much larger is the Commonwealth than this country? —than Brazil?

49. One-third of a yard contains how many twelfths of a yard?

50. Three-fourths of a mile is how many times three-eighths of a mile?

51. If I read one-sixtieth of a certain book each day, in how many days shall I have read three-fourths of it?

52. A man owning three-fourths of the grain in a granary gives one-sixtieth of the whole to each of his employes, exhausting the amount he owns. How many employes has he?

53. A man owning five-sixths of the shares of a mill company bequeaths the property to his nieces, giving to each of them one-twelfth of the whole stock. How many nieces has he?

54. Mary has two-thirds of a large basketful of apples, and gives to each of her girl friends one twelfth of the basketful, and has no apples left. How many girl friends has she?

55. If one-third of the office rooms of a building are equally divided among a number of law firms, each firm having one-twelfth of the whole number, how many of the law firms are there?

56. Three-fourths of the stock of a mill company is divided among some citizens of a village, each having one-twelfth of the whole stock. How many of these citizens are there?

57. In 1900 a scientist captured in dining rooms in different parts of the country 23,087 flies. The common house fly constituted 22,808 of these. How many flies of the other kinds were captured?

58. The house fly lays at one time about 120 eggs, which hatch in eight hours, and from which flies are fully developed in ten days. If a single fly produces four such layings in a season, how many flies will be produced directly from its eggs?

59. What day of the year is the 1st of May, counting from the beginning of the year?

60. A dollar, a dime, a nickel, and a cent for every day of the year amount to how much?

61. A certain great volume is divided into two principal parts. In the first part are 3 times 13 books, and in the second part are 10 + 17 books. How many books does the volume contain?

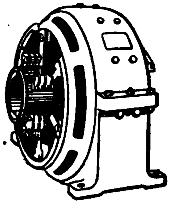
62. If a person could travel to the moon at the rate of 10,000 miles a month, how many months would it take him to reach the moon at a distance of 280,000 miles away? How many years would that be?

59. If a certain library contains 180 volumes of history and biography, 21 of poetry, 20 of drama, 36 of science, 25 of travels, and 240 of fiction, how many volumes does it contain? If now 70 volumes of bound magazines and 30 volumes of choice music be added, how many volumes will there be in all?

65. How many capital letters of the alphabet are reversible, like A, and when cut out can be turned either way? How many of them, like B, are not reversible, and can be used in only one way? A manufacturer of letters for use on windows and walls has an average of 100 each of those that are reversible and of 200 each of those that are not reversible. How many letters has he?

63. A flea can leap 200 times its length. If a man six feet tall could leap as far proportionally, how far could he go in ten leaps? There are 5280 feet in a mile. Could he leap more than a mile?

64. A certain hotel in a city buys a dynamo sufficient for the lighting of three hundred rooms, and pays for it the sum of $1250. As a reserve, to use in case of accident to the first dynamo, a second one is purchased at the same price. What is the cost of the two dynamos?



65. A county superintendent distributed a quarter of a pound of seed grains of model corn to each of five hundred pupils, for experiments in home gardens. At sixty-eight pounds to the bushel, how many bushels did he distribute?

66. A certain house has seven gables. Each gable has a window of two sashes, and each sash contains six panes of glass. How many panes of glass are there in the seven gables?

67. George is twelve years old, and Mary is two years old. George's age is how many times Mary's age? Three years later George's age will be how many times Mary's age then? Five years later still, George's age will be how many times Mary's age then?

EXERCISES FOR PRACTICE

in

ADDITION, SUBTRACTION, MULTIPLICATION, AND DIVISION

Arranged By

CHARLES L. SPAIN

Assistant Superintendent of Schools

Detroit, Michigan

SUGGESTIONS TO TEACHERS

The following Exercises for Practice have been arranged to assist pupils to develop accuracy and speed in the fundamental operations. Pupils should practice until they can **correctly** work every example in each exercise within the time limit prescribed for each grade in this table.*

Grade	4	5	6	7	8
Number of minutes required to work each exercise	3¼	2¾	2¼	2	1¾

Directions for Conducting Practice Exercises

1. A copy of this book should be in the hands of each pupil, and he should open the book to the exercise to be used.

2. Each pupil is to have a blank sheet of paper, which he places directly under the first row of examples to be worked. All answers are to be written on this paper. To avoid crowding the answers, the pupil should draw the paper slightly to the left after he writes each answer. Answers to examples in the second and succeeding rows are to be placed under the answers for the first row. No pupil is to write answers in the book. Exercises XV, XXXV, XLI and XLIV must be copied on paper before the practice exercise is begun.

3. Every exercise is to be accurately timed by means of a watch or clock. Start and stop pupils promptly.

4. As soon as the time has expired, the teacher will quickly read the answers to the examples. As she reads, each pupil checks the examples which he has worked incorrectly. As soon as the errors have been checked, the papers are to be collected by the teacher.

5. On the first day these exercises are given, all pupils are to begin with Exercise I. Pupils who are perfect in Exercise I will, on the following day, take Exercise II; while those who fail on Exercise I must repeat this exercise until they are perfect in it. As the time required for all exercises is uniform, no two pupils need necessarily work on the same exercise during any one class period. Each pupil may thus progress at his own pace.

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*This time schedule may not in every case be reached by a class so early as the teacher hopes and expects: but it should be kept in view as a standard *to be attained by continued practice.*

I. Addition

6	9	7	6	2	3	5	1	4	9	5	5
7	1	2	3	1	7	9	0	7	4	4	6
7	7	3	3	8	7	2	4	9	2	9	2

5	9	5	7	2	1	6	1	6	3	3	8
7	6	0	7	8	4	4	9	5	2	6	6
5	9	7	8	7	6	0	9	2	6	4	8

8	9	5	1	1	4	9	4	9	2	4	4
4	5	1	5	8	3	3	1	7	7	0	5
3	3	0	7	2	4	1	0	6	3	5	2

II. Subtraction

17	56	98	77	19	34	76	58	49	46	49	65
6	4	7	5	7	4	5	8	3	4	5	3

56	75	97	88	49	83	66	99	89	67	28	35
3	4	6	5	7	2	6	1	5	5	4	3

23	76	83	72	56	67	43	59	66	55	69
2	2	1	2	5	7	3	9	5	5	4

III. Addition

4	7	4	1	2	2	5	7	5	3
0	2	4	9	1	4	0	1	4	9
1	3	3	3	8	5	1	3	0	5
3	2	5	0	2	1	1	2	1	8
6	5	8	3	2	6	7	8	1	8

9	2	6	6	7	8	1	3	1
1	6	1	0	9	8	7	5	1
9	5	4	4	8	6	2	8	7
0	4	8	9	6	7	2	3	1
1	6	6	9	5	5	9	3	8

IV. Addition

55	31	47	24	14	24	32	70
32	48	51	62	15	33	36	18

17	43	20	20	26	81	42	22
72	21	13	50	73	13	27	16

48	33	52	75	32	17	12	26
31	33	41	21	23	62	26	51

V. Multiplication

25	46	58	94	87	53	85	67	26	49
2	3	7	5	6	7	4	8	9	5

24	19	28	91	87	39	83	16	54	57
4	2	5	3	7	4	9	7	6	3

VI. Addition

32	24	31	25	70	42	50	36
16	13	22	33	17	31	30	20
31	62	11	10	11	15	19	32

20	42	25	52	17	10	23	50
19	13	20	15	51	55	61	16
30	22	42	12	20	32	14	12

VII. Subtraction

68	57	79	32	61	89	75	78	39	48	59	35
27	34	25	21	20	55	60	18	22	36	54	15

44	52	76	53	67	31	44	89	74	42	80	33
31	41	74	33	20	11	22	67	53	32	50	21

VIII. Division

8)48 7)56 9)81 5)45 7)84 4)36 7)63 6)54

5)55 8)56 9)63 7)35 6)60 9)90 4)36 9)45

4)20 7)42 7)70 9)36 8)40 5)35 6)36 6)48

9)99 8)64 9)54 9)27 3)24 6)42 6)66 8)80

7)77 6)72 5)50 3)21 7)28 4)40 5)40 5)25

4)24 3)27 8)96 4)48 3)33 3)30 6)24 8)32

5)15 6)18 7)28 3)36 4)44 2)22 4)16

IX. Addition

35	63	48	37	67	38	59	62	67	42
17	27	13	15	26	32	25	18	26	29

49	17	36	27	35	64	34	39	55	24
42	55	15	54	25	26	48	22	18	28

X. Addition

5	7	6	9	9	7	1
3	5	1	4	5	7	1
5	4	3	8	7	0	1
1	7	4	5	9	4	0
5	6	9	6	6	9	7
7	8	6	9	1	3	8
7	3	4	1	7	7	9

4	6	9	6	6	4
4	4	6	4	7	5
1	2	4	7	9	1
1	9	8	8	7	8
6	7	2	8	7	6
6	5	5	5	5	7
7	2	7	9	4	8

XI. Subtraction

56	39	51	45	75	31	92	99
48	28	43	32	54	17	67	75

76	92	29	68	57	44	87	46
25	58	16	49	16	36	68	23

21	74	46	88	62	53	77	55
19	35	12	69	22	34	24	51

XII. Addition

2	6	5	4	1	3	2	5
3	4	4	1	2	7	5	1
2	4	7	5	3	2	3	9
1	1	3	7	9	7	5	7
4	4	3	3	7	8	1	6
1	4	2	2	8	4	4	7
2	2	5	6	5	2	2	5
5	6	3	4	2	6	3	3
3	2	2	4	3	3	6	1

XIII. Multiplication

158	572	327	689	215	379
4	7	9	3	8	5

427	526	917	669	537	329
3	5	4	2	8	8

XIV. Addition

75	77	85	96	56	89	66	47
38	35	39	34	79	46	54	95

37	46	26	35	32	58	96	34
85	68	75	77	99	47	45	77

XV. Division

$23\overline{)598}$	$17\overline{)306}$	$72\overline{)864}$
$38\overline{)456}$	$35\overline{)735}$	$27\overline{)729}$

XVI. Addition

58	15	18	22	16	12	52
19	13	47	29	11	25	29
$\underline{20}$	$\underline{32}$	$\underline{20}$	$\underline{20}$	$\underline{66}$	$\underline{37}$	$\underline{14}$

28	50	40	26	25	13	14
22	29	37	17	34	22	28
$\underline{27}$	$\underline{17}$	$\underline{14}$	$\underline{36}$	$\underline{14}$	$\underline{35}$	$\underline{42}$

XVII. Subtraction

63	41	74	63	81	70	84
$\underline{27}$	$\underline{25}$	$\underline{36}$	$\underline{19}$	$\underline{17}$	$\underline{29}$	$\underline{45}$

30	43	78	55	42	63	57
$\underline{22}$	$\underline{39}$	$\underline{49}$	$\underline{37}$	$\underline{17}$	$\underline{44}$	$\underline{48}$

48	41	64	47	40	22	53
$\underline{39}$	$\underline{33}$	$\underline{56}$	$\underline{38}$	$\underline{39}$	$\underline{15}$	$\underline{44}$

XVIII. Addition

22	69	35	61	75	37
29	41	36	54	37	54
70	50	57	37	22	71

67	27	53	37	90	31
43	22	75	25	79	57
51	95	27	87	88	68

XIX. Multiplication

48	57	72	85	92	83	50	76
30	40	50	20	60	70	80	40

84	35	48	53	71	38	93
90	60	40	80	90	20	30

XX. Addition

38	67	32	21	36	30	74	72
64	57	54	43	29	63	44	78
34	43	76	97	60	75	61	51
78	86	89	66	83	27	20	65
95	95	54	10	40	81	57	36

XXI. Division

$$\begin{array}{ccccc}
2\overline{)430} & 5\overline{)895} & 3\overline{)171} & 2\overline{)642} & 5\overline{)325} \\
6\overline{)474} & 9\overline{)756} & 4\overline{)372} & 2\overline{)198} & 8\overline{)472} \\
3\overline{)522} & 9\overline{)468} & 7\overline{)259} & 3\overline{)147} & 6\overline{)888}
\end{array}$$

XXII. Addition

$$\begin{array}{rrrrr}
111 & 635 & 326 & 784 & 869 \\
\underline{222} & \underline{340} & \underline{362} & \underline{215} & \underline{120} \\
362 & 441 & 150 & 655 & 252 \\
\underline{425} & \underline{236} & \underline{228} & \underline{132} & \underline{525} \\
631 & 725 & 795 & 438 & 651 \\
\underline{225} & \underline{262} & \underline{203} & \underline{351} & \underline{325} \\
521 & 573 & 435 & 726 & 522 \\
\underline{420} & \underline{315} & \underline{323} & \underline{252} & \underline{175}
\end{array}$$

XXIII. Subtraction

$$\begin{array}{rrrrr}
745 & 473 & 763 & 394 & 223 \\
\underline{48} & \underline{51} & \underline{86} & \underline{62} & \underline{58} \\
624 & 250 & 415 & 432 & 848 \\
\underline{55} & \underline{30} & \underline{97} & \underline{21} & \underline{59} \\
421 & 555 & 317 & 590 & 500 \\
\underline{38} & \underline{35} & \underline{58} & \underline{60} & \underline{73}
\end{array}$$

XXIV. Addition

127	423	377	265	188	177	509
346	369	208	127	506	718	306

223	351	746	462	119	227	148
547	329	136	228	239	136	226

XXV. Multiplication

427	342	872	951
12	27	36	27

XXVI. Addition

368	556	274	775	456	515
457	256	169	137	359	387

448	374	556	271	664	457
452	459	368	579	236	353

XXVII. Subtraction

678	465	546	388	394	189
354	123	124	235	181	145

857	311	385	618	621	785
640	200	352	303	611	463

157	141	383	468	124
133	120	202	357	114

XXVIII. Addition

34	73	29	19	22	25
23	29	28	77	43	72
26	93	35	81	46	84
11	58	15	52	24	20
53	54	93	51	70	12
17	13	20	30	83	64
56	16	47	48	21	27

XXIX. Division

20)600 30)900 40)120 50)550

70)490 60)300 80)240 20)800

40)280 70)630 60)420 80)400

30)270 80)480 80)640 50)250

20)140 90)810 70)350 20)120

50)700 70)280 50)300 60)660

80)800 90)630 50)750

XXX. Subtraction

579	856	634	755	384
445	587	312	557	272
227	883	359	472	786
105	595	244	186	555
449	200	326	791	327
228	185	222	693	207

XXXI. Addition

34	42	85	69	86
17	88	24	83	35
91	89	55	14	43
63	28	67	22	33
49	29	95	47	56
30	44	70	98	67
62	20	85	73	35
74	88	60	25	20
83	92	37	40	45

XXXII. Addition

764	843	597	634	488
886	568	488	397	536
927	848	368	456	543
384	153	645	844	567

XXXIII. Multiplication

452	147
121	362

572
251

XXXIV. Addition

$$\begin{array}{rrrrrr}
288 & 167 & 472 & 144 & 263 & 321 \\
326 & 221 & 149 & 186 & 175 & 490 \\
\underline{281} & \underline{482} & \underline{201} & \underline{214} & \underline{199} & \underline{129}
\end{array}$$

$$\begin{array}{rrr}
161 & 255 & 221 \\
185 & 245 & 178 \\
\underline{127} & \underline{105} & \underline{102}
\end{array}$$

XXXV. Division

$$89\overline{)8722} \qquad 84\overline{)7644} \qquad 37\overline{)2442}$$

$$21\overline{)2625} \qquad 84\overline{)6804}$$

XXXVI. Addition

$$\begin{array}{rrrr}
645 & 524 & 249 & 626 \\
256 & 190 & 462 & 257 \\
\underline{192} & \underline{309} & \underline{318} & \underline{199}
\end{array}$$

$$\begin{array}{rrrr}
488 & 676 & 507 & 496 \\
262 & 166 & 345 & 605 \\
\underline{413} & \underline{234} & \underline{159} & \underline{619}
\end{array}$$

XXXVII. Subtraction

753	228	374	783	831
386	169	185	299	564

823	912	973	211	243
337	864	699	186	178

433	741	256	555
277	666	167	478

XXXVIII. Addition

971	456	998	878	246	751
783	326	875	717	202	344
111	411	502	616	115	561
888	600	751	135	494	228
438	812	209	802	787	794

XXXIX. Multiplication

2344	3271
689	422

688
75

XL. Addition

422	492	555	862
567	835	122	545
895	976	263	535
361	524	962	262
227	327	165	213
426	831	447	991
772	991	887	104

XLI. Division

$72\overline{)16992}$

$33\overline{)792}$

$21\overline{)378}$

XLII. Addition

457	717	617	
913	308	297	
124	890	434	
718	383	456	
323	262	913	
444	999	363	422
353	424	802	560
232	282	791	789
666	415	345	671

XLIII. Subtraction

$$\begin{array}{r}865341\\ \underline{46233}\end{array}\qquad\begin{array}{r}723597\\ \underline{83701}\end{array}\qquad\begin{array}{r}583121\\ \underline{76243}\end{array}\qquad\begin{array}{r}895752\\ \underline{59863}\end{array}$$

$$\begin{array}{r}400271\\ \underline{38105}\end{array}\qquad\begin{array}{r}687094\\ \underline{54321}\end{array}\qquad\begin{array}{r}284463\\ \underline{18989}\end{array}$$

XLIV. Division

$$999\overline{)22977}$$

$$31\overline{)868}\qquad 39\overline{)936}$$

XLV. Subtraction

$$\begin{array}{r}357912352\\ \underline{87527286}\end{array}\qquad\begin{array}{r}975432186\\ \underline{78523321}\end{array}\qquad\begin{array}{r}545123615\\ \underline{80828268}\end{array}$$

$$\begin{array}{r}934105526\\ \underline{65687810}\end{array}\qquad\begin{array}{r}773642\\ \underline{55566}\end{array}$$

TABLES OF DENOMINATE NUMBERS

Dry Measure

2 pints .... = 1 quart .... (qt.)
8 quarts .... = 1 peck .... (pk.)
4 pecks .... = 1 bushel .... (bu.)

Liquid Measure

4 gills .... = 1 pint .... (pt.)
2 pints .... = 1 quart .... (qt.)
4 quarts .... = 1 gallon .... (gal.)
31½ gallons .... = 1 barrel .... (bbl.)
63 gallons .... = 1 hogshead .... (hhd.)

Avoirdupois Weight

16 ounces (oz.) .... = 1 pound .... (lb.)
100 pounds .... = 1 hundredweight (cwt.)
2000 pounds .... = 1 ton .... (T.)

One pound Avoirdupois = 7000 grains.

Troy Weight

24 grains (gr.) .... = 1 pennyweight .... (pwt.)
20 pennyweights .... = 1 ounce .... (oz.)
12 ounces .... = 1 pound .... (lb.)

One Pound Troy = 5760 grains.

Apothecaries' Weight

60 grains (gr.) .... = 1 dram .... (dr. or ʒ)
8 drams .... = 1 ounce .... (oz. or ℥)
12 ounces .... = 1 pound .... (lb. or ℔)

One Pound Apothecaries' weight = 5760 grains

Apothecaries' Liquid Measure

60 minims (m.) .... = 1 fluid dram .... (ʒ)
8 fluid drams .... = 1 fluid ounce .... (℥)
16 fluid ounces .... = 1 pint .... (fl. oz. or O)
8 pints .... = 1 gallon .... (cong.)

Measure of Time

60 seconds (sec.) .... = 1 minute .... (min.)
60 minutes .... = 1 hour .... (hr.)
24 hours .... = 1 day .... (da.)
7 days .... = 1 week .... (wk.)
365 days .... = 1 common year .... (yr.)
366 days .... = 1 leap year

Means For Measuring Dry Substances: *

Pint

Quart

Peck

For Measuring Liquids:

Gill

Pint

Quart

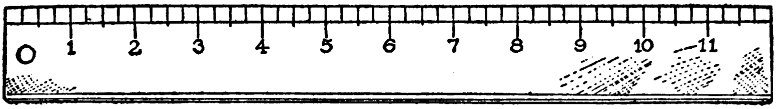
Gallon

For Weighing:

Scales

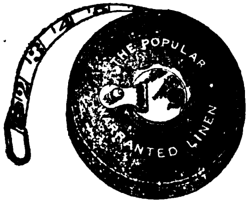
*All schools are not fully equipped with the various measures and instruments required in the study of Denominate Numbers. For this reason suitable illustrations accompany these tables, but necessarily reduced in size.

TABLES OF DENOMINATE NUMBERS

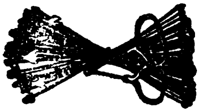


Foot Rule, reduced to one third of its true length.

For Measuring Lengths:

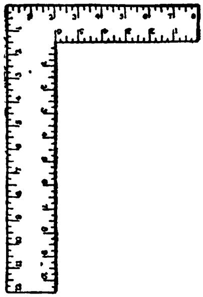


Tape Measure



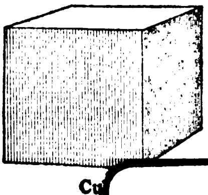
Surveyor's Chain*

For Surface Measuring:



Carpenter's Square

Illustrating Solids:



Cu

Linear Measure

12 inches (in.)............ =1 foot.................... (ft.)
3 feet........................... =1 yard................ (yd.)
5½ yards, or 16½ feet.. =1 rod..................... (rd.)
40 rods.......................... =1 furlong............ (fur.)
320 rods, or 5280 feet.. =1 mile................ (mi.)
1 mi. =320 rd. =1760 yd. =5280 ft. =63,360 in.

Surveyors' Linear Measure

7.92 inches (in.)........ =1 link......................(l.)
25 links..................... =1 rod..................... (rd.)
100 links..................... =1 chain.................. (ch.)
80 chains................. =1 mile ....(mi.)

Square Measure

144 square in. (sq. in.).. =1 square foot (sq.ft.)
9 square feet (sq.ft.) =1 square yard (sq.yd.)
30¼ sq. yd., or 272¼ sq.ft =1 square rod..(sq.rd.)
160 square rods............ =1 acre.................. (A.)
640 acres........................ =1 square mile (sq.mi.)
1 A. =160 sq.rd. =4840 sq.yd. =43,560 sq.ft.

Surveyors' Square Measure

16 square rods............ =1 square chain (sq.ch.)
10 square chains .... =1 acre.................... (A.)
640 acres........................ =1 square mile (sq.mi.)
1 square mile .... =1 section .... (sec.)
36 sections .... =1 Cong. township (T.)

Cubic Measure

1728 cubic inches (cu.in) =1 cubic foot....(cu.ft.)
27 cubic feet.............. =1 cubic yard..(cu.yd.)
128 cubic feet.............. =1 cord.................(cd.)
16 cubic feet.............. =1 cord foot......(cd.ft.)
8 cord feet .... =1 cord.................(cd.)

*Instead of the standard (Gunter's) chain, some sur-
tape 50 feet long, divided into foot
se being marked off into tenths.

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